IN MEMORY OF
JAMES JACKSON
LOWELL

FIRST SCHOLAR OF THE CLASS
OF 1858 & LEFT THE LAW
SCHOOL AT THE OUTBREAK
OF THE CIVIL WAR TO JOIN
THE 20TH MASSACHUSETTS
VOLUNTEER INFANTRY
MORTALLY WOUNDED AT
THE BATTLE OF GLENDALE
JULY 30TH 1862

FROM THE GIFT OF HIS SISTER
HARRIET LOWELL PUTNAM
M-CM-XVII
THE
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AMERICANA

IN THIRTY VOLUMES

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TOXINS AND ANTITOXINS

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KEY TO PRONUNCIATION.

äfar, father
âfate, hate
a or âat, fat
åair, care
âado, sofa
âall, fall
chchoose, church
eel, we
e or êled, end
êher, over; also Fr. e, as in de; eu, as in neuf; and oeu, as in boeuf, coeur; Ger. ö (or oe), as in ökonomie.
ëbefall, elope
ëagent, trident
ffoff, trough
ggas, get
gwanguish, guava
hhat, hot
h or HGer. ch, as in nicht, wacht
hwwhat
îfile, ice
i or îhim, it
i between e and i, mostly in Oriental final syllables, as, Ferid-ud-din
jgem, genius
kwquaint, quite
üFr. nasal m or n, as in embon-point, Jean, tempe
üSpan. ñ, as in cañon (cān’yōn), piñon (pēn’yōn)
ng mingle, singing
nkbank, ink
öno, open
o or ónot, on
ôcorn, nor
oatom, symbol
obook, look
oi oil, soil; also Ger. eu, as in beutel
öor oo fool, rule
ou or ow allow, bowsprit
ssatisfy, sauce
shshow, sure
ththick, thin
fhfather, thither
ümute, use
u or übut, us
üpull, put
übetween u and e, as in Fr. sur, Ger. Müller
vof, very
y(consonantal) yes, young
zpleasant, rose
zhazure, pleasure
'(prime), "(secondary) accents, to indicate syllabic stress
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the action of the trioxide itself upon moisture. Sulphur trioxide has a powerful affinity for water, in which it dissolves with a hissing noise and the formation of sulphuric acid, as indicated by the equation $\text{H}_2\text{O} + \text{SO}_3 \rightarrow \text{H}_2\text{SO}_4$. The reaction is accompanied by the liberation of a great deal of heat.

Sulphur combines directly with carbon, at a red-heat, with the formation of a substance known as carbon disulphide ($\text{C}_8\text{S}_2$) or (carbon bisulphide), which has the chemical formula CS$_2$. This action of which that is this produced may be condensed to a very volatile, mobile liquid, possessing a high dispersive action upon light. Carbon disulphide freezes at about $-166$° F., boils (under a pressure of one atmosphere) at $115$° F., has a specific gravity of 1.29 and a specific heat of 0.247, and is used as a solvent for resins, sulphur, phosphorus, gutta percha and many other substances that do not dissolve in water. It is almost insoluble in water, but mixes readily with alcohol, ether and many kinds of oil. It is exceedingly inflammable, and its vapor forms explosive mixtures with air. The vapor of carbon disulphide takes fire when heated in contact with air to 300° F., and this circumstance, taken in connection with the volatility of it is substance and the explosiveness of its vapor when mixed with air, renders the use of the disulphide exceedingly dangerous in the presence of any sort of a flame, or even in the presence of bodies heated as hot as 300° F. As ordinarily met with in commerce, carbon disulphide possesses an exceedingly efficacious odor; but this is due to impurities, and when these are removed, the pure disulphide has an ethereal odor, which is not objectionable. The vapor of carbon disulphide is poisonous, even when greatly diluted with air.

The known compounds that contain sulphur in combination with two or more other elements are almost innumerable, as are also the uses to which sulphur is put in the arts. Among the sulphur compounds containing sulphur with two or more other elements, the various salts of sulphurous and sulphuric acids are exceedingly important. For data concerning sulphur black and the sulphur compounds that are in general use in the coal color industry, consult Chas. T. Thompson, "The Synthetic Dyestuffs and Intermediate Products"; also Wahl and Atack, "The Manufacture of Organic Dyestuffs."

ALLAN D. RISTEN.

SULPHUR, Medical Uses of. Sulphur is prepared in various ways for use, both internally and externally, in medicine. It is used in the forms of washed, precipitated or milk of sulphur, and sublimate powders, or flowers of sulphur, corresponding to the manner of its preparation from crude sulphur — by washing, precipitation, or sublimation. The precipitated sulphur is regarded as the most efficacious, perhaps because of its finer division, which is chemical instead of mechanical. It is prepared by boiling equal parts of sulphur and freshly slacked lime for an hour, and then adding dilute hydrochloric acid until the alkali almost disappears. The sulphur precipitates as a white powdery mass, and is washed and dried at a low temperature. Precipitated sulphur is much employed as a mild laxative, taken in medicinal doses and by its action facilitates evacuation in cases where intestinal or rectal disorders pain-

fully interfere. Sulphur is also a valuable remedy in certain blood-diseases, chronic skin-diseases, chronic bronchitis, chronic rheumatism, etc., both internal administration — especially in the form of mineral waters containing sulphur — and sulphur baths being often efficacious. The administration of sulphur in obstinate chronic cases of many diseases often works such a change in the patient's condition as to give potency to other remedies given without effect. As a parasiticide, and especially in skin affections, ring-worm, itch, etc., sulphur ointment is a specific, or at least an active curative agent.

SULPHUR DIOXIDE. See Liquefied and Compressed Gases.

SULPHUR DYESTUFFS. See Coal Tar Colors.

SULPHUR SPRINGS, Tex., city, county-seat of Hopkins County, on the Missouri, Kansas and Texas, and the Saint Louis Southwestern railroads, about 240 miles northeast of Austin, the capital, and 75 miles northeast of Dallas. It is in an agricultural and stock-raising region and has an extensive domestic export trade in cotton products, wheat, corn, fruit (peaches and plums), honey, poultry and livestock. It has two national banks, a combined capital of $200,000. The educational institutions are the Central College (Methodist Episcopal, South), opened in 1876, and public schools. Pop. about 5,151.

SULPHURETTED HYDROGEN (H₂S), a gaseous compound of hydrogen and sulphur, found abundantly in nature in gases issuing from crevices in volcanic regions, and occasionally in natural gas. It is one of the common products of decomposition of vegetable substances, especially those of the lecanum family. It occurs in illuminating gas, from which it is scrupulously removed at considerable expense. It is prepared on a large scale by heating together equal parts of vaseline or paraffin and sulphur.

Sulphuretted hydrogen is a colorless, inflammable gas, burning with a bluish flame, and having an extremely offensive odor, similar to that of rotten eggs. It is very poisonous; when inhaled in small quantity producing nausea and headache, and in large quantity, asphyxiation. One part of the gas in 200 parts of air is fatal to horses, and one part of gas to 300 of air is fatal to dogs. It is soluble in water in the proportion of 4.4 volumes of gas to 1 volume of water at 32° F. At higher temperatures less of the gas is held in solution. Alcohol at 32° dissolves 17.9 times its own volume.

The aqueous solution of sulphuretted hydrogen is known as hydro sulfurous acid. It smells of the gas, and decomposes on standing, depositing sulphur, and the hydrogen oxidizing into water. Its solution in glyzerine, however, keeps good for a long time.

The gas may be liquefied at ordinary temperatures by submitting it to a pressure of 17 atmospheres — that is, about 250 pounds to the square inch. Liquid sulphuretted hydrogen is a colorless, volatile liquid which freezes or solidifies at $-117$° F, and boils at $-79$°. In its liquid form it is nearly inert chemically.

Sulphuretted hydrogen is used in large
quantities in the manufacture of sulphuric acid to remove the arsenic which is found in larger or smaller percentage in all acid made from pyrites. It is also used to precipitate copper from solutions containing salts of copper, and for precipitating gold and silver from sweepings and other waste material. In the chemist’s laboratory it is one of the most valuable reagents.

SULPHURIC ACID, or OIL OF VITRIOL, a common and exceedingly important oxy-acid of sulphur, having the chemical formula H₂SO₄. It was first prepared by Geber, in the 8th century, by distilling alun; and in the 15th century it was manufactured by burning sulphur with saltpetre, though the identity of the product so obtained with that described by Geber was not established until near the end of the 16th century. Considerable quantities of sulphuric acid were formerly manufactured by the distillation of ferrous sulphate, the practice of this method dating from the early part of the 18th century. At the present time practically all of the sulphuric acid that is prepared is from sulphur dioxide gas, either by the “chamber process,” or by the more recently perfected contact process, both of which are described in this article.

When pure and free from water, sulphuric acid is a colorless liquid with an oily appearance, and a specific gravity of 1.89. It may be readily frozen, the solidified acid melting again at 30° F. It exhibits the phenomenon of sublimation to a marked extent, and the liquid acid can be cooled, much below the melting point here given, without inducing solidification; but if a crystal of the solid acid, or a small amount of sulphur trioxide, be added to the supercooled fluid, crystallization begins at once, and the temperature rises until it becomes 50° F, after which no further solidification occurs. The presence of a trace of water in the acid lowers the freezing point nearly to 32° F. If five parts (by weight) of sulphuric acid be mixed with nearly one part of water, and the solution is cooled by a freezing mixture, a definite hydrate of sulphuric acid, having the composition H₂SO₄·H₂O, crystallizes out at 45° F. A solid hydrate, having the composition H₂SO₄·4H₂O, may also be prepared by cooling, to a much lower temperature, a mixture of sulphuric acid and water, containing 57.6 per cent of water. Several other hydrates are also believed to exist, and special study has been expended upon them, on account of their importance in the illustration of the hydrate theory of solutions. (Consult Mendeleeff, Principles of Chemistry, Vol. II.) Sulphuric acid has no really definite boiling point. It begins to boil at about 550° F, the distillate containing sulphuric acid, water and sulphur trioxide. (See SULPHUR.) The temperature of the liquid may be raised to 640° F, however, without danger. This definition is not so much in conformity to the boiling point of water, the vapor that passes off then consisting entirely of water vapor and free sulphur trioxide. At higher temperatures the decomposition is even more complete. Thus if a stream of the acid is allowed to flow over red-hot not being broken up into sulphur dioxide (SO₂), free oxygen and water-vapor. If the gases resulting from this decomposition are passed through cool water, and the steam that they contain is condensed and the sulphur dioxide removed by solution, a supply of pure oxygen gas is obtained. Pure anhydrous sulphuric acid has a specific heat, at ordinary temperature, of about 0.34, and a coefficient of expansion (Fahrenheit scale) of about 0.000310. The concentrated acid is a powerfully corrosive poison, destroying organic tissues rapidly, and even charring paper and wood. It is also poisonous (though far less violently so) when administered in any considerable quantity in a highly dilute form. Concentrated sulphuric acid has a powerful affinity for water, its combination with water being attended by the evolution of a large amount of heat. The strong acid is used as a drying agent, for removing moisture from gases. For this purpose it is sometimes sufficient to allow the gas to stand for a time in a receiver containing a dish of the concentrated acid; but a more effective result may be obtained by passing the gas through tubes that are partially filled with fragments of pumice that have been wetted with the acid.

Chemically, sulphuric acid is dibasic, either or both of its hydrogen atoms being replaceable by metals or other bases, the compounds that are thus formed being termed sulphates. With the metals of the alcali (which are monovalent), sulphuric acid therefore forms two kinds of compounds, which may be sufficiently illustrated by the potassium salts. If one of the hydrogen atoms of the acid is replaced by potassium, the resulting salt, HKSO₄, is called potassium sulphate; or acid potassium sulphate; while if both are replaced, the resulting salt has the formula KH₂SO₄, and is known as potassium sulphate. Many of the sulphates of the metals occur native in large quantities, and many of them are of great value in the arts. Those that are of especial importance are described, in this encyclopedia, under the metals (or other bases) with which the acid is combined. The sulphate of barium is perhaps the most insoluble salt known. It is formed whenever a soluble barium salt (such as the chlorate) is added to a solution of a soluble sulphate, and this formation constitutes a valuable test for sulphuric acid and the sulphates. See Chemical Analysis.

When sulphur trioxide is dissolved in anhydrous sulphuric acid in the proportion of one molecule of the trioxide to one of the acid, a definite compound having the formula H₅SO₃O (or H₅SO₃O₄) is obtained. When pure, this substance is known as pyrosulphuric acid. It is a dibasic acid, forming salts which are termed pyrosulphates. Pyrosulphuric acid (now commonly known in the arts as oleum) but formerly called “Nordhausen oil of vitriol” consists of a mixture of pyrosulphuric acid and ordinary sulphuric acid and may be regarded as a solution of sulphur trioxide in sulphuric acid. Pyrosulphuric acid is broken up into a quantity to convert the ordinary acid entirely into pyrosulphuric acid. It fumes strongly in the air, gives off sulphur trioxide when heated,
and is prepared by the "contact process," described in this article.

The uses of sulphuric acid in chemistry and in the arts are past enumeration; for this acid is one of the most important chemical substances known, and it is employed in so many industrial processes that it has been said that the wealth and prosperity of a nation can be estimated from its consumption of sulphuric acid. About half of the total quantity manufactured in the United States is consumed in the preparation of fertilizers. The two general methods now in use for manufacturing the acid are described in this article.

The sulphur used for the manufacture of sulphuric acid is obtained (1) from the gases generated by burning iron pyrites (FeS₂), (2) from the sulphur deposits of Louisiana, Sicily and elsewhere, and (3) to a very limited extent from the waste gases given off by sulphide smelters. At the present time pyrites is the most important source, but it is probable that smelter gases will be utilized to a greatly increased extent in the future, and they may eventually compete with pyrites. The sulphur dioxide that is now wasted by discharging the fumes into the atmosphere is as a rule used as a more than supply the United States with sulphuric acid. Moreover, the fumes are exceedingly objectionable, and they are destructive to vegetation.

The fundamental principles in the manufacture of sulphuric acid are (1) to oxidize sulphur or a suitable sulphide, so as to obtain sulphur dioxide, SO₂; (2) to further oxidize this to the trioxide, SO₃; and (3) to effect the combination of the trioxide with water, in accordance with the equation $\text{SO}_3 + \text{H}_2\text{O} = \text{H}_2\text{SO}_4$. In attempting to carry out the second of these processes, however, we are confronted by the fact that sulphur dioxide does not readily take up oxygen, so as to become completely converted into the trioxide. To effect this oxidation we are in fact compelled to resort to one or the other of two expedients: (1) To mix a certain amount of an oxide of nitrogen with the sulphur dioxide, and air — the oxide of nitrogen being as a rule "carrier," taking up oxygen from the air and passing it on to the sulphur dioxide; or (2) to subject a mixture of air and sulphur dioxide to the action of a suitable catalyst. The first of these expedients is used in the "chamber process" and the second in the "contact process."

The first step in the manufacture of sulphuric acid is to provide a suitable supply of sulphur dioxide gas. This is usually obtained by burning sulphur or iron pyrites in a special furnace and considerable skill and considerable care are required in this part of the operation, to obtain gases of proper composition. It is also important to minimize the quantity of dust that the gases carry over into the later parts of the process. Settling chambers, baffle plates, centrifugal separators, parallel-plate separators, and filtration through piles of marbles or other loosely aggregated solid lumps are among the devices used for the removal of the dust.

Chamber Process.—In manufacturing sulphuric acid by the "chamber process," the hot gases from the burners (consisting of air, sulphur dioxide and moisture) pass first over "niter pots," which contain nitrate of soda and sulphuric acid, and which give off the nitric oxide gas that is to act as an oxygen carrier. Then, after passing through the dust-removing apparatus, the gases are passed upward through a tower (technically known as a "Glover tower") that is loosely filled with fragments of coke, pumice, acid-proof stone, or other inert material to distribute the flow, and here they are met by a downward stream of aqueous sulphuric acid obtained from a later stage of the process, and the oxides of nitrogen in solution. The precise reactions that occur cannot be discussed here, partly because they are complicated, and partly because they are not fully understood. The general effect, however, is to oxidize the SO₂ to SO₃ and the downward-flowing stream of weak acid dissolves the SO₃ and thereby becomes stronger. In certain plants of recent design the oxidation of the sulphur dioxide and the absorption of the resulting trioxide are carried out in a series of Glover towers, without the use of chambers of any sort; but it is usual, after the gases have passed through one or two Glover towers, to cause them to enter large lead-lined chambers, from which the process takes its name. In such a chamber, more than supply the United States with sulphuric acid. Moreover, the fumes are exceedingly objectionable, and they are destructive to vegetation.

The liquid sulphuric acid settles in the bottom of these chambers, and is drawn off from time to time. Steam or water is sprayed into certain of the chambers, as needed, to provide the H₂O that is required for the formation of the H₂SO₄. The gases coming from the last chamber are passed up through a "Gay-Lussac tower," which resembles the Glover tower in general construction. The liquid that is sent down through this tower, however, is concentrated sulphuric acid, and its purpose is to absorb the nitric oxide gas that is present, thereby preventing its loss and diminishing the quantity of nitre that must be used in the early part of the process. Upon leaving this tower the gases (which then consist mainly of nitrogen and oxygen) enter a stack and pass off into the atmosphere. The acid that is drawn off from the bottom of the final Gay-Lussac tower contains excess of nitre, in solution, and is introduced (diluted, if necessary, with weaker acid) into the tops of the Glover towers. As the acid passes down through a Glover tower, however, the heat due to the reactions that occur, added to that which the entering gases already possess, drives off the nitrous oxides, and these keep returning upward through the tower with the sulphur oxides and air, while acid nearly free from nitrous oxides comes away from the bottom of the tower and is judged.

Sulphuric acid, as made by the chamber process (and especially when made from pyrites) is likely to be contaminated with lead, arsenic, nitrous oxides and many other substances. Certain of these may be removed in considerable measure by treatment with sulphuric acid. If an acid of high purity is required, however, it is better to make it by the contact process, presently to be described. When treated with sulphuric acid for the removal of metal impurities, the acid have a greater specific gravity than 1.4, corresponding to about 50 per cent of actual H₂SO₄, and must be diluted to this strength if
it is already stronger. After the removal of the arsenic the purified acid is concentrated by evaporation if a strong product is required. The evaporation may be carried out in leaden pans, set over a centigrade thermometer, recording the concentration in platinum stills. Owing to the high cost of platinum, however, it is common to perform the evaporation in a series of evaporating dishes constructed of fused silica. These are arranged like a flight of steps, the lip of each one projecting out over the next dish below. A slow stream of acid is kept running down through the cascades of dishes, while heat is applied to each dish from below. When an apparatus of this kind is properly arranged and operated it gives excellent results. Hoods should be arranged over the dishes, however, to take up the vapors that are given off and dispose of them in some proper way.

The Contact Process.—In the contact process for the manufacture of sulphuric acid, the sulphur dioxide is caused to combine with the oxygen of the air by bringing the mixed gases into contact with finely divided platinum, or with platinized asbestos. The catalytic action of platinum (that is, its power of inducing one combination in this way, without being itself consumed or otherwise permanently affected) was discovered by Sir Humphrey Davy, in 1818; and in 1824 Dobereiner showed that finely divided platinum can effect the ignition of a jet of hydrogen, when this gas impinges upon it in contact with air. Peregrine Phillips, of Bristol, England, first produced sulphur trioxide by utilizing the catalytic effect of finely divided platinum upon a mixture of oxygen and sulphur dioxide, taking out a patent for this process in 1831; and Schneider, in 1848, made a working model of an apparatus for manufacturing sulphuric acid by this method. Since that time many attempts have been made to make the contact process practicable for the manufacture of sulphuric acid, and many other catalytic agents have been tried besides platinum. It was not until about 1898, however, that the various practical difficulties involved in the process were satisfactorily overcome, largely through the labors of Herr Knietsch of the Badische Anilin- und Soda-Fabrik, a German company for the manufacture of chemical substances of nearly every kind. It was found that the prime condition of success in the application of the contact method is that the gases that are treated shall be absolutely free from dust, arsenic, mercury and certain other substances. The gases from the pyrites-roaster are cooled very slowly and are then purified by filtration and washing. When passed to the tubes containing the platinized asbestos that is used as the catalytic agent, 100 volumes of the roaster-gas contain 7 volumes of sulphur dioxide, 10 volumes of oxygen and 83 volumes of nitrogen (from the air). The catalytic platinum is maintained at a temperature of about 750° F., since it is found that at this temperature the production of sulphur trioxide is about 98 per cent of the theoretical production. The nitrogen that is present has no influence upon the reaction, when the apparatus is working properly. The sulphur trioxide that is produced by this method needs only to be dissolved in previously prepared sulphuric acid containing more or less water, in order to yield an acid that is quite pure. It might naturally be supposed that water would be the best absorbent for the trioxide; but it is found that an acid that contains from 97 to 99 per cent of H₂SO₃ is the best absorbent; and in the practical conduct of the process the trioxide is absorbed by an acid of this strength; the stronger acid that its solution yields being continuously drawn off and continuously replaced by fresh supplies of the 97 to 99 per cent acid, except when fuming acid of a very high degree of concentration is wanted. The minute details of the contact process are trade secrets and are carefully guarded.

The standard work on sulphuric acid manufacture is Lunge's "Sulphuric Acid and Alkali." Very good general accounts will be found, however, in Rogers' "Manual of Industrial Chemistry" and Thorp's "Outlines of Industrial Chemistry."

Allan D. Risteen.

SULPHURIC ETHER. See Ether.

SULPHURIC ACID, an acid having (probably) the formula H₂SO₃, and prepared by dissolving sulphur dioxide gas (see Sulphur) in water to saturation; the acid being formed by the union of one molecule of the dioxide with one molecule of water, according to the equation SO₂ + H₂O = H₂SO₃. Sulphuric acid has never been isolated, and is known only in its aqueous solution, in combination with bases in the form of the salts known as "sulphites," and as a solid hydrate. At 70° F. water dissolves about 35 times its own volume of sulphur dioxide; the solubility being greater at lower temperatures, and less at higher ones. When an aqueous solution of sulphuric acid is cooled below 41° F., a crystalline hydrate of the acid separates out, the composition of which is not definitely known. Sulphuric acid has the taste and smell of sulphur dioxide gas, and is strongly acid. It readily gives off sulphur dioxide gas, and upon standing in contact with the air it gradually absorbs oxygen and becomes converted into sulphuric acid. Its composition is also modified by the action of light, probably by the formation of a more complex oxy-acid of sulphuric acid, combining with the oxides, hydrates and carbonates of many of the metals to form salts (that is, sulphites) which are readily decomposed by the addition of stronger acids, with the liberation of sulphur dioxide. It is used in the bleaching of silk and wool but not so much as formerly, having been largely displaced by hydrogen peroxide. When the hydrogen atoms of the acid are both replaced by a metallic base, the resulting salt is called a "normal sulphite," and when only half of the hydrogen of the acid is so replaced, the salt is called an "acid sulphite," or a "bisulphite." Both of the sulphites of sodium are extensively used in photography; the normal sulphite having the formula Na₂SO₃·H₂O, and the acid sulphite the formula H₂Na₂SO₄. (See PHOTOGRAPHY). Industrially, the bisulphites of calcium and of magnesium are of exceeding importance, since the aqueous solutions of these substances possess the power of dissolving the gummy matters by which the pieces of wood are cemented together. Upon this property, the "sulphite process" for the
SULPICIANS, SUL-pish’-tən. See Orders, Religious.

SULPICIUS SEVERUS, SUL-pish’-ús say-vehr’-əs, Roman ecclesiastical writer; b. Aquitania, 363 A.D.; d. Marseilles, between 410 and 429. He was from a family of high rank and in the practice of the law at Toulouse attained a great reputation for learning and eloquence and led a gay though charitable life. The death of his wife led him to more serious pursuits. Having entered a monastery, he spent some years in preparing an abridgment of the scriptural narrative, which from the purity of its style was long a favorite textbook in the schools of the Middle Ages, but is liable to the charge of serious tampering with the facts, arising in part probably from the desire to rehuke in this guise some contemporary rulers. He continued this history, describing the destruction of Jerusalem and bringing the narrative down to his own time, under the title of 'The Chronicle of Sulpicius Severus,' in which he varies materially from Josephus. His other works are 'Life of St. Martin,' Bishop of Tours; 'Three Dialogues' and a collection of letters. From the elegance of his Latinity he was called, not undeservedly, 'the Christian Sallust.' His works have been often printed.

SULTAN, in Arabic, signifies monarch, ruler. The title is borne by various Mohammedan rulers, while the Turkish emperor assumes the title of Sultan-es-selatin, 'Sultan of Sultans.' The daughters of the sultan have also the title of sultan. The title of sultana is given out of Turkey to the chief concubines of the sultan, but no such title is in use for them in Turkey. If the mother of the sultan is living she is styled Sultan Valide.

SULU, soo-loo', or JOLO, hō-lō', Philippines. (1) An archipelago, consisting of over 400 islands, forming the southern central portion of the Phillipine Archipelago, lying between the parallels 4° 30' and 121° 52' N. lat. and the meridians 119° 25' and 121° 52' E. long.; area 1,029 square miles. The archipelago is surrounded by the Sulu and Mindanao seas on the north and west, and the Celebes Sea on the south and east. The islands form a long chain extending from northeast to southwest and are divided into five principal groups: (1) Balangungui; (2) Pagturiyang; (3) Sulu; (4) Tapul; (5) Tawi Tawi. The larger islands are generally high and of volcanic formation; the smaller islands are low and rest on coral; mountain chains traverse the islands of Sulu and Tawi Tawi. The larger islands are fertile; rice, coffee, chocolate, corn, hemp, saffron, indigo, sesame and cotton are cultivated, but not as a rule for export. The raising of horses, cattle and goats is an important industry; there is some metal working in the manufacture of chisels, knives, etc., and weaving for home consumption. The chief industry from the commercial standpoint is pearl and pearl shell fishing, large quantities of pearl shell especially being exported; other exports are shark's fins, beche de mer and native cordage. The trade is largely Chinese. The forests contain many of the most valuable woods of the East. The people of the archipelago are divided into four groups, according to their origin and customs: (a) The Guimbañanos, the aborigines living in the mountains; (b) the Malay and Visayan races; (c) the Samalés; (d) the Moros proper, the dominating race. Mohammedanism is the prevailing religion; polygamy and slavery are recognized institutions. Piracy was formerly a regular occupation of the Moros, depredations were carried as far as Singapore. (See Moros). Spain never occupied but a few towns on the coast and the native government remained largely independent of Spanish dominion. When the islands were transferred to the United States, after the Spanish-American War, negotiations were immediately begun for establishing satisfactory relations between the United States government and the sultan of Sulu and his datos (or chiefs). In August 1899 a treaty was signed in accordance with which the sovereignty of the United States over the whole archipelago was recognized, but the government of the sultan and datos continued under this supreme jurisdiction, the rights and religion of the Moros to be preserved. The following important stipulations: the United States shall occupy and control such parts of the archipelago as public interest demands; any person can purchase land with the sultan's consent; piracy shall be suppressed; the Moros courts shall have jurisdiction except between Moros; the American government shall protect the island against foreign aggression. Pop. (estimated) 22,080. (2) A group of islands in the central part of the Sulu Archipelago, lying between the Balangungui group on the north and the Tapul group on the south; area 380 square miles. All of the larger islands of this group are volcanic, each of them being formed of a central peak sloping to a narrow stretch of level coast land; the islets are generally rocks. All the staples of the archipelago are cultivated; a small amount of hemp and indigo is exported; but cattle raising and fishing occupy a larger number of the inhabitants. The trade between the islands is by native craft; the port of export is the town of Sulu. Pop. 14,500. (3) An island, the central and largest one of the Sulu group; area 333 square miles. It is traversed from northeast to southwest by three nearly parallel mountain chains, between which lie fertile valleys; there are several important peaks, of which the highest has an elevation of 2,894 feet. There are numerous small streams; which are nearly or completely dry during the summer season. The climate is particularly good, the temperature being even and unusually cool for the latitude. The soil is fertile and is well cultivated; rice, however, is imported and the chief articles of export, as in the rest of the Sulu Archipelago, are the products of the fisheries. The mountains are heavily wooded and valuable cabinet woods are also among the exports. Under the American jurisdiction, a school has been established on the island. (4) A town, capital of the Sulu Archipelago, situated on the SW coast of the Sulu Island, 540 miles south of Manila. It was the ancient residence of the Sulu sultans, but scarcely a trace of the ancient Moro town remains; the present town was built in 1878 by the Spanish and is surrounded by walls within which the town is regularly laid out, with three principal streets, broad and well
shaded. The houses are mostly well built and there is a large modern market house. It is the chief town and chief port of the Sulu Archipelago and carries on a copious trade with Singapore and Manila, as well as a native inter-island trade. In the channel between the roadstead and Maroñas is a pearl oyster bed, which employs a large number of fishing boats and the town is the centre of this industry.

SULZBERGER, sulz'ber-ger, Mayer, German-American jurist; b. Heidelberg, Germany, 22 June 1843. During the Revolution of 1848 his father came to America with his wife and family, settling in Philadelphia in 1849. He received his early education at the public schools where he graduated in 1859 from the Central High School, being at the same time an apt pupil at home in Hebrew language and literature. On 16 Sept. 1865 he was admitted to the bar, where his career was brilliant and his commanding abilities received their recognition on his appointment as judge of the Court of Common Pleas (1895-1915), and presiding judge in 1909. Sulzberger edited The Occident for a year after its founder's death, was tendered the position of United States Minister to Turkey during President Harrison's administration but declined the honor, is prominently identified with Jewish charities and instructions, and is a trustee of the Baron de Hirsch Fund. He is the author of 'Am ha-aretz' (the ancient Hebrew Parliament) (1909); 'The Polity of the Ancient Hebrews' (1912); 'The Ancient Hebrew Law of Homicide' (1915).

SUMAC, any shrub or tree of the genus Rhus. Some species are poisonous to the touch. (See Plants, Poisonous). One of the most common innocent eastern species of America, and the largest, is Rhus hirta, the staghorn sumac, so called because its young, short branches are covered with down, in color and texture not unlike a deer's antlers in the velvet. The trees are not more than 30 feet high, but are apt to grow in clumps and have a tropical appearance, with their long pinnate leaves turning to vivid yellow and crimson in autumn. Their autumnal beauty is further enhanced by the torch-like pinnate of fruits, small drupes matted together by the crimson plush of the hairs that cover them in pyramidal bunches terminating the branches. These fruit-masses remain throughout the winter, and are a favorite food of chickadees, in spite of the fur and the acridulous taste. The sour flavor was taken advantage of by the Indians and colonists who made a cooling drink from the plant. The crimson hairs also yielded a red dye, when immersed in boiling water. The wood is yellow and handsomely veined, but is very brittle; it is, however, occasionally made into canes. The fragrant, or sweet-scented sumac (Rhus aromatica), is an aromatic leaves and large panicles of greenish, honey-scented flowers which bloom in spring and are a famous food for bees. R. glabra is the upright or smooth sumac, which is smooth and even glaucous; its leaves were added to the tobacco of the aborigines; and an efficient garden plant and a thrifty shrub. The dwarf black or mountain

sumac (R. copallina), similar in size to the above species, and like them having panicles of bloom succeeded by scarlet masses of drupes, is more bushy in character and carried by the plants in sandy or dry, almost sterile soil, and is peculiar in that the main stem of its compound leaves bears conspicuous wings between the leaflets. The latter are shining above, and pubescent beneath, and, like those of R. glabra, when dried are material for tanning, the winged fruits are, however, said to be inferior to those of the Rhus coriaria, native to and cultivated in the Mediterranean regions, which are especially valuable for tanning fine leathers, as the light-tinted moroccos. They are collected, dried, and exported in great quantities in the shape of a fine dust. The Venetian sumac, or smoke-tree, is also used for the same purpose. (See Smoke-Tree). The sumacs are very useful tree shrubs to the Indians of the western United States. The twigs of Rhus trioloba, the aromatic sumac, having small three-lobed leaves, are soaked, scraped and split, resoaked in water, and then woven into baskets, sometimes in conjunction with other materials. These light, straw-colored wishes are used probably more than any material except the native basketry. R. diversiloba, the poison-oak, although greatly dreaded by the Cherokees, who endeavor to conciliate it by addressing it as 'my friend,' does not seem to injure certain Californian tribes so much. They even use it as medicine, sometimes poisoning themselves internally by the practice, and use twigs of it as water-sprinklers in sacred ceremonies; it is also a material for woven fabrics. Its juice, which turns black rapidly on exposure to air, is utilized as an intense black dye for basketry. R. trioloba likewise yields a dye. A strong decoction of the leaves and twigs is made, to which is added roasted pinyon gum and yellow ochre, forming a rich, blue-black fluid, which is practically an ink, the tannic acid of the sumac combining with the iron in the yellow ochre, and being strengthened with the carbon of the burnt gum. The lacquer or varnish of China and Japan is nothing but the sap of another sumac (R. vernicifera), the varnish-tree, cultivated in those countries. When the bark is cut, the shrub exudes a juice, darkening after exposure. When kept for some time this sap becomes thick and viscous, blackish-brown in color in one mass, but yellow-brown and transparent in thin layers. When properly applied in successive layers and dried, it becomes a natural varnish of great hardness and unalterability. Nut galls, or iron in solution, added to this, or gold and other metals, make the various kinds of lacquer or japanning, which it often takes years to perfect. Japan wax is a vegetable wax used chiefly for candles and obtained by crushing, steaming and pressing the drupes of this species and of the Asiatic R. succedanea.

SUMATRA, soo-ma'tra, an island in the Indian Seas immediately under the equator. Its extreme limits are lat. 5° 45' N., and 5° 55' S.; long. 90° 40' E., and 106° 5' E. In the direction of its greatest length it extends from northwest to southeast. Its greatest length is about 1,000 miles, and its greatest breadth about 260 miles; its area is about 161,000 square miles. It ranks in magnitude as the second of the
SUMATRA

Asianic islands, Borneo being the first. The population is about 4,000,000.

The western side of the island is mountainous, but the east side has a totally different character, and spreads out into innumerable plains nearly as level as the sea. The mountains viewed from the west appear at first view to form a continuous ridge, but a closer examination reveals breaks in the chain, and discloses the fact that two or three ridges lie behind that which is mainly seen from the coast. This chain, known generally as Barisan, extends from the northwest of the island to Sunda Strait. The islands of Pulo Bras and Pulo Wai really form detached parts of it, and near them, at the northwestern end of the island, it attains a height of 3,663 feet in Mount Yamura. Farther south, but still in Acheenese territory, are the lofty volcanoes Abong-Abong and Lusé, whose heights are estimated at over 11,000 and 12,000 feet respectively. Mount Ophir, close to the equator, is an extinct volcano 9,610 feet above sea-level. Not far to the southeast is Mount Moba, the most visited of Sumatran volcanoes. Other notable peaks are: Talang (8,343), an extinct volcano, from which the natives obtain sulphur; Indrapura (12,000), the highest peak yet ascended in Sumatra; Mount Paung; Mount Kaba (5,413); Mount Dempo (10,562), an active volcano; and Mount Tangkamus (7,422), near the Straits of Sunda. Granite, slates, clay-chests and similar rocks abound, and limestones of Carboniferous age occupy much of the surface. Tertiary formations cover a very large area. All the peaks seem to be volcanic. Various metals have been found in the island, and excellent coal is known to be abundant.

Rivers and Lakes. The rivers that flow toward the west are naturally short and of small importance for navigation, but those traversing the broad alluvial eastern slopes are long and deep. Many of them form large deltas. In order from south to north the most important are: the Musi or Palembang, about 400 miles long, passing the town of Palembang and entering the sea opposite the island of Banka, an important highway for trade; the Jambi or Batang-Hari, over 500 miles long, and navigable throughout its entire length, is the natural outlet for the coal-fields; the Indragiri; the Kampar; the Siak, rising near Mount Ophir; the Rakan and the Batu Bara. Of the west-coast rivers the Singkel is the most important. The lakes of Sumatra are mostly mountain lakes, and not a few of them occupy the craters of extinct volcanoes. The largest are: Toba, 500 square miles in area, at the source of the Singkel River; Singkara and Marungin, about the centre of the island near the west coast; Korinchi, near Indrapura; and Danau. Sumatra is almost bisected by the equator, and in consequence the monsoons of its northern extremity have different directions from those of the southern end. During the period when the north monsoon is blowing, navigation in the neighboring waters is impeded by squalls. The climate is generally of the usual tropical character, and is on the whole rather unhealthy.

Sarawak. The flora of Sumatra differs much from that of Java. It is very rich in forest trees, many of which yield valuable timber or other useful products, such as benzoin and gutta-percha. Pepper is the chief cultivated product. Sago and rice are also cultivated, and excellent. Copra and rice are grown for export. The fauna of Sumatra in some respects resembles that of Borneo more closely than that of the countries with which it is almost in contact. The elephant and the tapir, frequent in Sumatra, are unknown in Java. The former island has the two-horned, the latter a single-horned rhinoceros. The orang-utan is found locally. The tiger occurs both in Sumatra and Java, but not in Borneo; Sumatra has also some species of deer and antelope, the sunbear, a peculiar kind of hare, and the muntjac. The most notable birds are the Argus pheasant, several trogons, bush-shrikes, rain-birds, pheasant-cuckoos, etc. Of the domesticated animals the most important by far is the pig, next to which rank the cow and the horse. The buffalo is more frequent in the low country, but is only valued as food, and never yoked for labor as in Java. The horse of the highlands is small, but vigorous and capable of enduring the most arduous work.

Government. The authority of the Dutch extends, nominally at least, over the greater part of the island, and may be considered to be real over all the coast districts. In the interior, however, there are still considerable numbers of native rulers, or forming village confederations, over which the Dutch exercise little or no authority. The Dutch possessions are divided into six chief divisions. The government of the west coast, with an area calculated at 31,649 square miles, extends along the middle portion of the west coast, and includes Padang and other districts. The governor resides at Padang. The residency of Benkulen lies to the south of that of the west coast, and has an area of 9,399 square miles, Benkulen being the capital. The residency of Lampang comprises the southern districts of the island on the Strait of Sunda, and has an area of 11,284 square miles. The residency of Palembang on the east coast, with an area of 53,497 square miles, lies to the north of Lampang, and has as its capital the large town of Palembang. The district of Indragiri, farther north, belongs to the residency of Kio, which is named after the island of that name. The residency of the east coast, its area being estimated at 35,312 square miles; and at the extreme north-west that of Achin, which still remains semi-independent, area 20,471 square miles.

Racial Characteristics. Sumatra is inhabited by a very mixed population. Malays col-lected from every quarter of the archipelago inhabit the coast. Hindus appear to have settled at an early age in the north, and to have modified the Malay type of the Acheenese. The Arabs in the island, though few in number, have always formed an important class. Chinese are numerous, particularly on the east coast. Northwest of Palembang the Orang-Kubu live in a savage state, and shun any intercourse with the white man. The Kubu must not be confounded with the people of Menankabu, a pure Malay race inhabiting the highlands of Padang, which some are disposed to consider the original seat of the Malay stock. The Batakans are a peculiar and interesting race. Like the Malayans they are of short stature, but they differ from the former in being strongly built and well proportioned. The
art of writing has been known among the Bat- 
taks from a date beyond the reach of tradition. 
Their characters are peculiar, and also their 
mode of writing, for they begin at the bottom 
of the page at the left-hand side, and place 
letter above letter in a vertical column till they 
reach the top, when they return to the bottom. 
Their ancient books are written in a bright red 
ink on paper made of the bark of trees, but 
now they scratch their writings on slips of 
flattened bamboo. Among all the indigenous 
tribes of Sumatra the characteristic political 
tendency is one that could have originated only 
in the recesses of the mountains. Every village 
affects independence, but the villages form 
federations. The native tribes of Sumatra have 
no temples and no priests. They are said to be- 
lieve in the existence of an evil spirit and of 
demons who haunt the mountains. On the coasts 
Buddhism appears to have been introduced at 
an early age, but it has since been completely 
superseded by Mohammedanism, which, among 
the Malays, however, is of a very relaxed char- 
pacter.

History.—The first European who visited 
the island of Sumatra is said to have been Nic- 
colo de Conti, who came there before 1449. 
In the beginning of the 16th century it was 
visited by the Portuguese, but no Europeans obtained 
a firm footing on the island until the Dutch estab- 
lished a factory on the west coast at the end of 
the 16th century. In 1666 the Dutch took 
possession of Padang, and soon after enlarged 
their territories by treaty with the Sultan of 
Achinn. Since that time they have gone on con- 
tinually consolidating and increasing their do-
minion much more by negotiation than by force 
of arms. Their last important accession of in-
fluence on the island was gained by a treaty 
with the king of Siaik, concluded in 1808, 
by which they obtained the virtual control of 
that state. In 1685 the British formed a settle-
ment in Bentjlen, and in 1811 they seized the 
Dutch possessions on the island. These were, 
evertheless, restored in 1824 Bentjlen 
was given over to the Dutch in exchange for 
Malacca. A treaty concluded between the Dutch and English governments in 1834 left 
the Dutch free to make what treaties they pleased with the native tribes of Sumatra, the same liberty being allowed to 
the British on the Malay Peninsula; but the 
right of the Dutch to make advances in the 
land by conquest and annexation was not 
then recognized. This right was, however, con- 
ceded in the treaty of February 1871, in return 
for the cession to the British of the Dutch pos-
sessions on the Gold Coast; and in accordance 
with this permission the Dutch despatched an 
expedition against Achinn. In April 1873, the 
forces of the two powers came into collision, 
and a war ensued which dragged on for a num-
ber of years, caused severe losses to the Dutch, 
and terminated only in the nominal subjugation 
of Achinn. In August 1883 the tidal wave that 
appeared among the islands of Krakatoa, swept with destructive effect the 
west coast of Sumatra, a total change in the 
aspect of the Straits of Sunda also resulting 
from the eruption. Consult Bernard, 'A 
time in Sumatra' (London 1903); Paston, H., 
'Sumatra' (Leipzig 1902); Cabatén, A., 
'Java, Sumatra, and the other Islands of the 
Dutch East Indies' (New York 1914).

SUMBAWA, Sumerian Languages 11

SUMBAWA, soom-ba'wa, an island be-
longing to the Sunda group, in the Indian 
Ocean, east of Java, containing 5,192 square 
miles. The island is mountainous and of ex-
traordinary profile. The volcano of Tomboro 
or Tombura, 8,940 feet high, is near the nor-
thern coast and famous for its eruptions. The 
Sunda consists of two parts, with two rulers of 
Sultans, who acknowledge the sovereignty of 
Holland. There are few streams. The chief 
products are rice, cotton, tobacco, tropical fruits 
and sappan-wood. Of domestic animals deer 
and swine are plentiful, and the finest horses 
of the Indian Archipelago are reared here, and 
exported. Edible birds' nests are found on 
the coasts; gold, silver, saltpetre and peals 
from the mines and waters, respectively. On 
the north coast there is a good harbor, and 
here stands the town of Sumbawa. The inhabi-

tants are Malays and Mohammedans. Pop. 
75,000.

SUMBUL, an East Indian name of the 
sparikenard (Mardostachys), and also of 
the valerian, but, more particularly of Ferula sumbul, 
the commercial drug also known as musk-root. 
The last is an umbelliferous herb, with deeply 
divided leaves. The roots reach the pharmacists 
in transverse segments, light and spongy in 
texture, with a thin, brown, wrinkled and fi-
brous skin, but whitish inside. The taste is 
bitter and balsamic, the odor strong and like 
musk. Sumbul is used therapeutically as a stim-
ulant and nervine, and was of importance long 
before its botanical history was known.

SUMERIAN LANGUAGES. The pris-
tine, agglutinative language spoken by the earli-
est, prehistoric people of Mesopotamia, a region 
generally referred to in surviving documents as 
mar Shumer or Akkad, i.e., land of the Sumer-
ians and Akkadians, probably the biblical Shinar 
or Shin'aar. It was a non-Semitic people thus 
dwelling in the lowlands between the Euphrates 
and Tigris, as comparative philology has of 
recent years proved beyond a doubt. True, the 
eminent French scientist, Joseph Halévy, in 
1876, and certain of his followers, contends 
for the non-existence of any such early non-
Semitic population. Halévy attempted to ac-
count for the myths and cuneiform characters 
by assuming a Semitic, priestly, secret style of writing, a cryptography, 
and cited as a parallel the Egyptian hierarchical 
writing. However, this has since been amply 
disproved. The meaning of the word Sumerian, 
or rather Shumerian, refers to the word *reed,* 
*reedy* in that idiom, evidently because of the 
marshy, reedy landscape. The Sumerians and 
the Akkadians seem to have formed one people, 
though originally they may have come from 
different parts of the earth. The Sumerians, 
at any rate, as their tongue, an agglutinative 
one, shows, must have come from the north, 
possibly the Ural region, as there were no 
words or word pictures among the phrases in it 
symbolizing fauna authentic to either of them. 

So far as the records go, the Sumerians 
were the earliest nation, and their system of 
writing, the cuneiform, is likewise the earliest 
we know of. Later on, the Sumerians, by co-
habitation and Bretemization, were amalgamated 
with the later Semitic invaders, 
Arab tribes originally coming chiefly from the 
island of Bahrain. The Sumerian tongue like-
SUMMARY COURT — SUMMER

wise coalesced in a manner with the Semitic idiom, the latter being superimposed on the former, much as the New Testament French was superimposed on Anglo-Saxon, and thus the later Babylonian was formed. Semitic civilization and language, however, were highly developed before the coming of the Semites, as well in the construction of their cities as in its religion, its religious observances, its legislation, arts, science and social life. The Semitic Babylonians imbibed the earlier civilization.

Nevertheless, the "Sumerian problem," so-called has for generation perplexed Assyriologists. Oppert, in 1854, first made modest, though in a measure successful attempts to unravel its mysteries. But Prof. Paul Haupt, assisted by Prof. Peter Jensen and Zimmern, somewhat profiting by these initial labors, steadily bewed his way through these etymological brambles, and it is strikingly illustrative of the value of Haupt's pathbreaking labors that all subsequent phonetic and grammatical work in Sumerian has only tended to confirm Haupt's views in instance. Haupt's "Sumerian Family Laws" and "Akkadian and Sumerian Cuneiform Texts" laid the foundation to all later researches. In the investigation of the Sumerian idiom no comparison should be made between Sumerian vocabularies and those of more recent agglutinative idioms, despite frequent tempting resemblances, such as in Turkish, for instance. Now and then, though, certain similarities are traceable with Estonian and Finnish. Sumerian, as far as has been shown up to the present, must be held a language standing alone by itself, a "prehistoric philological remnant."

To Prof. Friedrich Delitzsch is due the merit of having clearly shown the full meaning, the derivation and development of Babylonian cuneiform signs. They were, then, at first pure picture writing and finally grew into conventional ideographic and syllabic sign lists. The etymological labor involved in this process of gradual elucidation was surrounded with enormous difficulties.

Sumerian cuneiform was adopted at least about a.c. 7000. By a.c. 5000 we see it already highly specialized, and between a.c. 4000 and 3000 we perceive it applied to the transmission of the invading Semitic language, the Babylonian; and since then the Semitic Assyrians, the Medes, the Turanian Susites, and the Caucasian Armenians have all habitually used the cuneiform.

Besides other evidence tending in the same direction, perhaps the most convincing proof, from a philological point of view, that ancient Sumerian was a real idiom, of natural growth and wholly unartificial, may be found, aside from the internal phonetic changes, in the indubitably established fact that there were two dialects of it. These were the Emesal, the man's language, the noble, virile, though harsh form, and the Emenal, the woman's language, the softer. There were no geographical boundaries to these two dialects. In R. E. Brunton and C. F. W. Fairweather's "A Dictionary of all Simple and Compound Ideographs" (1889), it is also demonstrated that the Sumerian original idiom was of unaided growth. He and others point out that there were probably eight voice tones employed in Sumerian, similar to the Chinese of to-day, and that the intonation often determined the meaning. As a possible illustration may be cited: aβewith, moisture, dew, tears, inundation, irrigation; abβ—dwellings, sea, road, and a grammatical suffix.

After Sumerian had ceased to be a living tongue it was, up to a very late period of Babylonia's existence, greatly used as a ritual one, and was read aloud at worship in the temples, much as is, for example, early Slavonic in Russian and other Orthodox churches to-day.

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WOLF VON SCHIEBREND, Author of 'America, Asia and the Pacific,' etc.

SUMMARY COURT. See LAW, MILITARY.

SUMMARY PROCEEDINGS, in legal form of trial in which the ancient established course of legal proceedings is disregarded, especially in the matter of trial by jury. In no case can a party be tried summarily unless when such proceedings are authorized by legislative authority, as in a committal for contempt of court, the conviction of a person by justices of the peace, etc.

SUMMER, the season of the year which in the northern hemisphere generally may be said to comprise the months of June, July and August. The astronomical summer lasts in the northern hemisphere from the June solstice to the September equinox, during which time the sun, being north of the equator, shines more directly upon this part of the earth, and rises much sooner and sets later, which renders this the hottest period of the year. The period of greatest heat generally takes place in August, since the influence of the sun's rays has then been felt for a long time on the earth, and the winds are blowing to a moderation of the temperature in the polar circle caused by the thawing of the ice. In the southern hemisphere the summer lasts from the December solstice to the March equinox.
SUMMER DUCK—SUMMER SESSIONS

SUMMER DUCK. See Wood-duck.
SUMMER REDBIRD. See Tanager.

SUMMER SCHOOL OF THE SOUTH, a school for teachers established at the University of Tennessee, Knoxville, in the summer of 1902. It was organized to supply the ever-increasing demand on the part of southern teachers for a summer school of high grade and adequate equipment for the best normal training. It receives its financial support from the General Education Board, from the University of Tennessee, from the citizens of Knox County, and from individual donations; the registration fee is small. All the buildings and full equipment of the university are given to the use of the school. The courses number over 150. The work is arranged in the following groups: (1) Common school and primary grades; (2) psychology and pedagogy; (3) high school and college subjects; (4) rural schools and county supervision; (5) city school supervision; (6) general lectures; (7) professional exhibits; (8) conferences. Teachers have free choice of subjects, but are advised not to take work for more than three or four periods a day. The instructors and lecturers are men and women of recognized scholarship and authority, coming from various institutions and different sections of the country. The school has a large attendance and has proved a marked success.

SUMMER SESSIONS. The summer school responds to a specific need. Professional people such as teachers, ministers, doctors, and other workers like social workers, Y. M. C. A. and Y. W. C. A. secretaries and even business men and women, find the summer vacation period a suitable time to undertake advanced educational work in specially selected subjects. The other seasons of the year are devoted to exhausting labors; the summer study is both recreative and inspirational and may be made to contribute to professional advancement. When systematically planned and extended over a period of years, summer work may even have recognition in the form of academic credit or academic degrees.

Of the persons listed above teachers in service make the most insistent demand for summer courses. New methods and new educational movements continually call for special short courses. For example, the Montessori method, or the Direct Method in Latin, may be studied to advantage in this way. Teachers may add to their regular accomplishments certain special, perhaps new, activities, such as domestic science and art, various phases of handwork, craftwork, physical education, elocution, etc. Again, a famous teacher from a foreign land may offer courses during a summer session, affording attractive opportunity for special investigation, or for getting a particular method or a particular form of interpretation in a known field. It is a growing practice among municipal school authorities to offer special inducements to public school teachers to take summer courses. The elementary teacher more particularly, but the high school teacher also to some extent is tempted to stagnate. After teaching the same subject several years, the dull monotony of the process deadens the ambition. This is especially true where knowledge of method is more important than knowledge of subject matter as in the elementary school. The opportunity for summer study is especially inspiring in such cases. Physicians also find it desirable to investigate new treatments, to observe and learn new methods in surgery, to get a new point of view in the profession. The summer session or clinic may give the desired opportunity to the farmer demands special opportunities for the observation of special methods and practices and looks to a short session of the Agricultural College to supply his needs. In this case, however, the winter may offer greater advantages.

Recently efficiency experts have advocated the continuous use of educational plants. The idle recitation halls, laboratories and libraries are considered uneconomical. This idleness may continue from 15 June to 15 September, 25 per cent of the educational year. Apparently this record only 75 per cent efficiency for faculties, plants and investments. For the faculty the inefficiency is only apparent since the fall months are essential to the increase in fertility and resourcefulness of the plant, however, and of the invested funds, the charge of inefficiency is partly true. If a separate faculty can be provided to use the equipment during the summer, a faculty that has its fall months at another season of the year, then an all year program becomes efficient.

The Four-Term Year.—A continuous session plan was devised at Chicago University by President William Rainey Harper, who stated that institution was first opened in 1892. It provides (1) four terms of twelve weeks each; (2) twelve terms completed work are required for graduation; (3) a student may complete twelve terms in three years; (4) that a student may select any three terms, as a year's work, devoting the other term to rest or business; (5) that a member of the faculty may elect to be absent from college duties during any one term of any calendar year.

This plan accomplishes at least that summer sessions usually seek to do and much more. (1) It incorporates the summer session as an integral part of the academic year. The summer term differs in no essential respect from any of the other terms. (2) Students may begin their college or university courses four times each year. (3) The university equipment is in continual use. (4) The university can use the best men from other institutions in this country and even from foreign universities.

The continuous session plan or the four-term year is the logical development of the summer school movement. Its sponsor, Chicago University, has used it continuously from 1892 to 1918. A quarter of a century has tested the plan thoroughly and has justified it. That few other colleges and universities have adopted it is no argument against it. It seems probable that acquaintance with its features and its satisfactory results will gradually lead to a wide if not universal use of it.

History of Summer Schools.—The Concord School of Philosophy was proposed by Ralph Waldo Emerson as early as 1840 and came to full fruition between 1879-85. The Harvard Summer School has lived from 1869
to the present. The Chautauqua Summer School began in 1874. A summer school of law was opened in 1870 by the University of Virginia. From these beginnings have grown institutions not only of most of the colleges and universities conduct such schools but Chautauqua schools. Y. M. C. A. and Y. W. C. A. schools, music schools, tutoring schools, normal schools, library schools, etc., are meeting the growing demand for summer school facilities. According to the latest report (1916) of the United States Bureau of Education 674 schools were in session during the summer of 1915, 47 universities, 40 colleges, 90 normal schools, 39 other institutions, 456 independent schools.

All colleges and universities listed offer academic credit for work completed in the summer session. Of 90 normal schools listed, only 46 offer credit. The basis for such credit is 30 hours of recitations, implying 60 hours of preparation for each credit-hour. A student may usually earn four credit-hours in one summer session. Since a college year is given 15 credit-hours, it will require four summer sessions to earn a full credit-year.

The process is, therefore, slow, but thousands of students persist until they earn the coveted credit-year. Especially is this true of students whose college course was interrupted and who in this way complete work for the bachelor's degree; and many college graduates take this means of earning a master's degree.

**A. R. BRUBACHER, President of State College for Teachers, Albany, N. Y.**

**SUMMERS, George William:** b. Fairfax County, Va., 4 March 1807; d. Charleston, W. Va., 18 Sept. 1868. He entered Ohio University at Athens, Ohio, in 1819 and graduated in 1825. He then studied law and was admitted to the bar in 1827. In 1830 he was elected a member of the lower house of the Virginia legislature and was later re-elected several times. In 1841 he was elected to the United States House of Representatives, and was re-elected in 1843. In 1850 he was elected to the Virginia Constitutional Convention and took a prominent part in framing the new constitution. In 1851 he was the Whig candidate for governor of Virginia, in the first popular election for governor in Virginia, but was defeated by Joseph Johnson, the Democratic nominee. In May 1852 he was elected judge of the eighth judicial circuit of Virginia, but resigned his office 1 July 1858. He was a prominent member of the *Peace Conference* held at Washington in the spring of 1861 and took an active part in defense of the Union. He was also elected a delegate to the Richmond convention which passed the Ordinance of Secession. In the convention he made an able speech in defense of the Union. At the opening of the Civil War he retired to private life upon his farm but continued to accept one and later was sent to be a member of the peace commission. He wielded a large influence in western Virginia.

**SUMMERS, Süm'ers, Thomas Osmund, American Methodist Episcopal (South) clergyman:** b. near Corfe Castle, Dorsetshire, England, 11 Oct. 1812; d. Nashville, Tenn., 6 May 1882. In 1830 he came to the United States where he studied for the ministry and was admitted to the Southern Conference in 1835. He was active in the organization of the Texas Conference, 1840, and later was sent to the Alabama Conference. He was professor of systematic theology at Vanderbilt University, dean of the faculty and pastor ex officio of that university. He has published *Commissions, Rituals, and the Gospels; the Ritual of the Methodist Episcopal Church (South); 'Seasons, Months and Days'; 'Talks, Pleasant and Profitable.' Consult *Life* by Fitzgerald (1894).

**SUMMERSIDE, Canada, town and port of entry of Prince Edward's Island, capital of Prince County, on Bedeque Bay and on the Prince Edward's Island Railroad. It is 40 miles northwest of Charlottetown and has an excellent harbor with anchorage for the largest vessels. There are flour and saw mills, manufactures of plows, etc., and it is the centre of the recently developed fox ranch industry. Summerside has regular communication in summer by steamer with Nova Scotia and New Brunswick. Pop. 2,678.**

**SUMMERSVILLE, Ga., city in Richmond County and suburb of Augusta. It lies in a fertile valley 25 miles north-northwest of Rome, on the Central of Georgia Railroad. On account of its mild winter climate it is a popular winter resort. It contains a government arsenal and ordnance department. Pop. 4,901.**

**SUMMIT, N. J., city in Union County, on the Delaware, Lackawanna and Western Railroad, 20 miles west of New York and 12 miles west of Newark. It is in an elevated part of the county, about 450 feet above tide water. Summit was settled in 1795, and the first school was built the same year. The first church building was erected in 1840. It was incorporated as a township in 1859 and as a city in 1899. It is a purely residential community, noted for its beautiful rural and suburban climate. The chief industries which contribute to the prosperity of the city are manufacturing silk goods, cultivation of roses, farming and the cultivation of fruit. Summit is a residential city, and has many New York and Newark business men among its inhabitants. The municipal improvements include gas and electric lights, pure water, an excellent tide water sewerage system, well-organized police and fire departments, free postal delivery and telegraph and telephone service. There are eight churches, Y. M. C.A. building and the Arthur Home for Blind Babies under the International Sunshine Society. The educational institutions are Kent Place School, for girls; Summit Academy, for boys; five public schools, one parish school and a free public library. The two banks have a combined capital of $200,000. The government is vested in a mayor and a council of seven members, who hold office for three years. Pop. 9,136.**

**SUMMONS, in law, an admonition to appear in court, addressed to the defendant in a personal action. It is the writ by which a personal action is always commenced. According to English law it need not state the form or cause of action, but it must contain the names of all the defendants, and must have endorsed
upon it the name and address of the person taking it out, whether the plaintiff himself or his attorney. It is the duty of the person taking out a summons to serve it on the defendant in person; but if the judge is satisfied that reason and good conscience requires it, and that the defendant knows that the summons has been issued against him, he may authorize the plaintiff to go on with the action without personal service.

SUMNER, Charles. American statesman; b. near Haverhill, Mass., Jan. 8, 1811; d. Washington, D. C., March 11, 1874. His family was English in origin, Charles being a descendant in the seventh generation from William, who came to America about 1635 and settled at Dorchester, Mass. The Summers lived in the same vicinity for the next 200 years and more, generally as farmers. The father, Charles Pinckney Sumner (b. 1776; d. 1839), graduated from Harvard in 1796. He was a lawyer, was married to Relief Jacob of Hanover, N. H., in 1810 and had nine children, of whom Charles was the eldest. The father took an active interest in politics, was clerk of the Massachusetts House of Representatives in 1806–07 and 1810–11 and from 1825 to 1839 was sheriff of Suffolk County. He was noted for his temperance and in 1811 armed himself and was strongly anti-slavery in feeling. He was fond of books, conscientious, earnest, grave and stern. It was not strange, then, that he brought up his son in the old Puritan style and the latter's career shows that he was greatly influenced by his father's teaching, views and character.

Charles was educated at the famous Boston Latin School, having as schoolmates Robert C. Winthrop and Wendell Phillips. His tastes were those of the scholar and he read widely and became proficient in the classics. He entered Harvard College in 1826, where he continued to excel in the classics, but also devoted much time to history and literature and perfected himself in oratory or declaiming. After a year spent in private study and diligent attendance on the lectures and orations of the great Boston orators, Webster, Everett, Choate and Calhoun, he entered the Whig Lyceum School in 1831 and received the personal attention and teaching of Judge Story, an old friend of Sumner's father. His plan of study was thus described in a letter to a friend: "Six hours, namely, the forenoon, wholly and solely to law; afternoon, classics; evening, history, subjects collateral and assistant to law, etc. Recreation must not be found in idleness or loose reading." In January 1834 he entered the law office of Benjamin Rand in Boston. In February he made a journey to Washington, where he received his first impressions of slavery in the South. His first subscription for a newspaper was for Garrison's Liberator. While in Washington he heard Webster, Clay and Calhoun deliver in the Senate, but he still thought he preferred law to politics. During the next three years, 1834–36, he practised law in Boston, but without remarkable success. His arguments were in the nature of learned essays rather than the public orations of the case in a manner to convince jurors.

In 1837 he went abroad and spent three years traveling in France, England, Italy and Germany. In Paris, where he lived five months, he attended university lectures, visited the museums, galleries and historic places, attended the Chamber of Deputies and law courts, went into society and met many eminent persons. He next spent 10 months in England and met the famous men of the day, Carlyle, Wordsworth, Macaulay, and many of the best Italian literature. Then he spent several months in Germany and finally returned to America in May 1840. His foreign travel unfitted him for his chosen profession, to some extent, and still further intensified his longings for the scholar's career.

During his absence abroad the slavery question had become a burning issue, though up to this time he had but slight interest in politics or in the great public questions of the period. From 1841, however, his letters commence to show evidence of more positive views on the slavery question and more determination to oppose the further spread and influence of this institution. His humanitarianism showed itself in his interest in popular education and in the support of Horace Mann, in the work for the blind, in that for the improvement of prison discipline and in his opposition to war under all circumstances. In 1843 he commenced to/utilize against slavery, and contended, in opposition to many, that it was a national rather than merely a local evil: that the nation was responsible and that it might to a large extent remove the evil by abolishing slavery in the District of Columbia and in the Territories, by compelling the rendition of fugitive slaves, by preventing the slave trade, by remedying the laws of slave States which abridged the right of free negroes in free States, by stipulating the conditions of admitting new States and by amending the Constitution so as to abolish slavery. Sumner made his real débüt in public life by a Fourth of July oration in Boston, 1845, on the "True Grandeur of Nations," in which he bitterly denounced wars of all kinds as dishonorable. Four months later he made his first anti-slavery speech at a meeting in Faneuil Hall to protest against the annexation of Texas.

In 1846–47 Sumner made several speeches in favor of the Whig party and was afterwards a general slavery attitude. He wrote for the newspapers against the Mexican War; declared that it was unconstitutional, unjust and detestable, opposed further expenditures for it, called for the withdrawal of troops and opposed the annexation of the territory to be acquired from Mexico to slavery. He joined the Free Soil party of 1848 and was nominated for Congress in October, but failed of election. When Webster, in his speech of 7 March 1850, refused to vote to exclude slavery from California and New Mexico, he became, in the eyes of many in Massachusetts, an apologist of slavery and this situation opened the door of the Senate to Sumner.

In Massachusetts the autumn campaign hinged on the question whether the State should approve the Compromise of 1850 and the course of Webster in supporting it. There was bitter opposition to the Fugitive Slave Law and the manner of its enforcement. Sumner made an important speech in Faneuil Hall 6 November against the Fugitive Slave law and demanded its repeal. This speech made possible his election as senator in January 1851, for in the State election the combined Democrats and
Free Soilers had a majority of the legislature and chose Sumner rather than Winthrop, the Whig candidate, as senator. With the entrance of Sumner into the Senate, a new force for anti-slavery agitation was present. He was an uncompromising, fiery, earnest, and persistent antagonist of slavery. He was the spokesman of the anti-slavery forces in the Senate as Calhoun was for the pro-slavery interests. Although the leaders of both parties were for peace, Clay and Webster on one side and Cass, Buchanan and Douglas on the other, nevertheless Sumner believed that the Compromise of 1850 was wrong and that "nothing can be settled which is not right." It was not until August 1852, after both the Whig and Democratic National Conventions had declared their support of the Compromise of 1850, that Sumner spoke of the great question, viz., "Freedom National, Slavery Sectional." His argument was to the effect that slavery was not recognized in the Constitution, that Congress had no power to establish it and that, therefore, it could not legally exist where the jurisdiction of Congress met; that the Fugitive Slave Law was unconstitutional and, therefore, should not be obeyed. This speech made Sumner the leader of the anti-slavery party and his doctrines were accepted as sound by a rank and file.

The next Congress, that commencing 5 Dec. 1853, was made famous by the passage of the Kansas-Nebraska Bill, which was designed to repeal the Missouri Compromise. It was on 23 Jan. 1854 that Senator Douglas introduced a bill dividing the Nebraska Territory into Kansas and Nebraska. This bill declared that the Missouri Compromise was superseded by the principle of the legislation of 1850, commonly called the compromise measure, and is hereby declared in operation. Sumner spoke against the bill 15 Feb. 1854 and declared that the Missouri Compromise was a binding contract. His speech on 26 June in reply to an attack on Boston and Massachusetts by Southerners, particularly Sen. Butler of South Carolina and Mason of Virginia, aroused great feeling.

The passage of the Kansas-Nebraska Act led to the formation of the Republican party. A Republican convention, composed mostly of Free Soldiers, was held at Worcester, Mass. 7 Sept. 1854 and Sumner spoke for the new party. He advocated resistance to the enforcement of the Fugitive Slave Law and advised the passage of personal liberty laws to nullify its workings. He justified his position by denying that the provision of the Constitution touching the rendition of persons held to service or labor was conferred any power on the national government to establish uniform rules for the rendition of fugitives; that therefore, each State had the right to determine for itself the extent of the obligation assumed. In consequence the Fugitive Slave Law was unconstitutional and the States had a right to act in December 1853 in rendering a fugitive slave the right of trial by jury and the privilege of habeas corpus. This view would give the States liberty to construe the Constitution and pass laws which their construction of the Constitution permitted. In case there was a conflict between the Supreme Court and the States in the construction of the Constitution, then no man "will voluntarily aid in enforcing a judgment which in conscience he believed wrong." This was preaching revolutionary doctrine and was the most violent and extreme position which Sumner had taken up to this date.

In the second session of the 33d Congress, that commencing December 1854, Sumner endeavored to forestall the legislative re-enactment of the Fugitive Slave Law, but was defeated. In the spring of 1855 he prepared an address entitled "The Anti-Slavery Enterprise, its Necessity, Practicability, and Dignity, with Glances at the Special Duties of the North." This was delivered in Boston, New York and other places.

It was in this address that he prophesied the downfall of slavery because of a "moral blockade" against it. With the sympathy of all Christendom as allies, already it (Anti-Slave movement), encompasses the slave masters by a moral blockade, invisible to the eye, but more potent than navies, from which there can be no escape except in final capitulation. Two of the great events of the session of Congress that met in 1855 were Lincoln's speech of 19 and 20 May 1856, on "The Crime against Kansas," and the assault on him by Representative Brooks of South Carolina. It was on 12 March 1856 that Senator Douglas reported a bill for organizing a State government in Kansas. This provided that the steps taken should be prescribed by the territorial legislature. This was the pro-slavery legislature which had been elected in March 1855 as a result of fraudulent votes which had entered Kansas for this purpose. Congress had to decide whether it would recognize this legislature or admit Kansas as a free State under the Topeka constitution, which had been formed by the free-state men in the convention which met at Topeka 23 Oct. 1855.

The debate on the subject began 20 March and continued for some months. Conditions in Kansas had been going from bad to worse and pro-slavery troops had been disarming free-state settlers, and finally, on 21 May, they made an attack on Lawrence, demanded the surrender of all arms, broke the presses of the newspapers, burned the Free State Hotel and plundered houses and dwellings.

It was under such circumstances that Sumner delivered his famous and carefully prepared speech which he meant to be the most thorough philippic ever uttered in a legislative body. In this speech he reviewed the whole case from the passage of the Kansas-Nebraska Bill up to the time of the attack on Lawrence. He criticized the administration and attacked his opponents in the most bitter language, especially Senators Butler of South Carolina and Douglas of Illinois. The former had chosen a mistress to whom he made his vows, and who, though ugly to others, is always lovely to him; though polluted in the sight of the world, is chaste in his sight; I mean the harlot Slavery. Douglas had used language and doctrines which brought forth the reply that "no person with the upright form of a man" could be allowed to switch out from his tongue the perpetual stench of offensive personality. Sir, that is not a proper weapon of debate, at least on this floor. The noisome, squall, and nameless animal to which...
I refer is not the proper model for an American senator. Will the senator from Illinois take notice? These bitter personalities led to the order by President S. Brooks, a representative from South Carolina, and a cousin of Senator Butler. The Senate had adjourned and Sumner was seated at his desk writing letters, when Brooks entered and said, "Mr. Sumner, I have read your speech to the Senate and I am here to destroy it, as was possible, and I feel it my duty to tell you that you have libeled my State and slandered a relative who is aged and absent, and I am come to punish you for it." He then struck Sumner a series of blows on the head with a guita percha cane, until he fell bloody and senseless to the floor. An effort to expel Brooks from the House failed because of lack of two-thirds majority. While a resolution of censure was pending Brooks resigned, but was immediately re-elected by his constituents. His action was generally upheld by the Southern leaders and press. The indignation in the North was intense, and the incident crystallized sentiment against slavery more, perhaps, than any other single event had done up to this time.

Sumner was re-elected to the Senate in January 1857, but, owing to the state of his health he spent nearly four years abroad, returning in time to resume his seat in the Senate 5 Dec. 1859. It was not until June 1860, however, that he delivered an important speech on "The Barbarism of Slavery." It was intended as a reply to numerous assertions recently made to the effect that slavery was a moral, social and political blessing, and "enabling to both races, the white and black." The speech was a reservoir of facts drawn largely from Southern sources, and an appeal to the great moral sentiment of the North to help abolish the system.

In the session of Congress which opened 3 Dec. 1860, Sumner devoted himself to preventing any compromise between the slave and the free States; for his object was the destruction of slavery. When the Southern senators withdrew as a result of secession, the committee was reorganized, and Sumner was made chairman of the committee on Foreign Relations. In this capacity he rendered the country signal service during the war. He was largely instrumental in the surrender of the captured Confederate commissioners, Slidell and Mason, who had been taken from the English mail steamer Trent by Captain Wilkes while on the high seas. He showed the President that this would be in accordance with our doctrines and an abandonment of claims made by England to which we had always objected. He used all his influence to prevent foreign intervention, and opposed the use of force in an attempt to get the French troops out of Mexico, as it might result in war. He was opposed to the issuing of letters of marque, and when the bill was passed used every effort to prevent the law going into effect, in which he was successful. His action was that of a friend with foreign nations. His speech in New York, 10 Sept. 1863, was a strong statement of the American position. He raked England for her unfriendly acts with respect to neutrality and for allowing Confederate cruisers to be fitted out in English ports, and called France to account for her intervention in Mexico. The speech had an inpr view upon the French government to bring a check on England. He made an exhaustive report on the French Spoliation Claims. He argued vigorously for the treaty for the purchase of Alaska in 1867. He was in favor of settling all questions of dispute with England and in bringing the two nations into relations of harmony and good will, and hence supported the efforts to settle the Alabama claims. Owing to a disagreement with President Grant and Republican senators over the acquisition of Santo Domingo, which Sumner opposed, he was removed from his chairmanship of the Committee on Foreign Relations, 10 March 1871.

Sumner supported the policy of emancipation and wished to take the step before Lincoln finally acted because he thought that it would prevent foreign intervention. He made the first public demand for emancipation by a responsible statesman on 1 Oct. 1861, before the State Republican Committee of Massachusetts, and repeated his demand in a number of a number of a number of speeches in the next few months. In the session of Congress which met in December 1861, he spoke in favor of legislation to prevent the surrender of fugitive slaves by the Union army, and in favor of the abolition of slavery in the District of Columbia, the first public word on the subject since the Republican party came into power.

During the war and after he was active in furthering the interests of the negro. He was influential in getting ratified the treaty with England for the more effectual suppression of the slave trade. He proposed bills allowing colored persons to become mail carriers, for enlisting negroes freed by Confiscation Act and for receiving colored volunteers. He proposed and carried legislation preventing the exclusion of witnesses in the courts of the District of Columbia on account of color. He voted against the bill to admit West Virginia, because the Senate refused to amend it so that after 4 July 1863 slavery should cease in that State. He was continually urging Lincoln to issue the Emancipation Proclamation. He introduced a bill in the Senate to repeal all fugitive slave laws, and succeeded in getting a similar bill, which had been passed in the House, through the Senate. He began the contest for negro suffrage, was a leader in his effort to prevent the exclusion of colored persons from street cars in the District of Columbia, supported a bill to secure for colored soldiers equal pay with the white and was energetic in getting the bill passed to establish the Freedman's Bureau, which Sumner called "a bridge from slavery to freedom." He also aided in forcing a repeal of the law which excluded colored testimony in the United States courts, and was largely responsible for the admission of a colored man to the bar of the Supreme Court, the privilege being granted by Chief Justice Chase on motion of Sumner. He offered an amendment to one of the reconstruction measures to the effect that "every constitution in the new States shall require the legislature to establish and maintain a system of public schools open to all without distinction of race or color."

On the question of reconstruction, Sumner
felt that the conditions must be faced by Congress and the President together, and hence opposed the policies of Lincoln and Johnson, viz., reconstruction by the executive. He considered this policy unconstititional while the Constitution supported the authority of Congress to declare war, and to keep the peace, and the power of the President to arm the territory, to protect the Union, to suppress insurrection, and to enforce the laws. He called this the policy of a "tyrannical executive," and he was a consistent advocate of States' rights. He held that a federal government could exist in this Union a republican form of government. He voted for the conviction of President Johnson in his impeachment trial.

After his removal as chairman of the Committee on Foreign Affairs, Sumner exerted little influence in the Senate, and occupied his time mainly in pressing civil rights bills for negroes. He supported Horace Greeley for President in the election of 1872, on the ground that he was an "unserving" Republican, that principles must be preferred to party and that Grant was unfaithful to the Constitution and Republican principles.

The character of Sumner and his services to his country were both based on fidelity to great moral ideas. He was sincere, unselfish, simple, kind, conscientious, honest and pure and without envy or personal animosity. He was also energetic, uncompromising, courageous and fearless, and indomitable in his purpose. On the other hand, while not entirely a man of one idea, his intense convictions on slavery often helped to defeat his desires, because of his inability to give sufficient weight to other important interests. He became egotistical, domineering, and was lacking in a sense of humor. Next to Lincoln he undoubtedly did more to win freedom for the colored race than any other man. His other great service was in keeping the country out of war with England and France during the latter part of the period of the Civil War, when such a catastrophe might easily have led to a permanent dissolution of the Union.

Bibliography.—The best short life of Sumner is that by Moorfield Storey ('American Statesmen Series,' Boston 1900). Other biographies are those by Edward Lillie Pierce, 'Memoir and Letters of Charles Sumner' (4 vols., Boston 1877–93); by Anna L. Dawes, 'Charles Sumner' ('Makers of America Series,' New York 1892); by George H. Putnam, 'In America: Biographies of Philadelphia, Copyright, 1909'); by G. H. Grimke, 'Life of Charles Sumner, the Scholar in Politics' (New York 1892). The 'Works' of Sumner were published in 15 volumes, Boston 1874–83. A famous oration on Sumner is that by L. Q. C. Lamar, 27 April 1874. Consult also Shotwell, W. G., 'Life of Charles Sumner' (New York 1910), and Whipple, E. P., 'Recollections of Eminent Man.' Some of Sumner's most famous speeches have been printed separately, viz., 'Report of the War with Mexico,' and 'Speech on the Crime against Kansas' (Directors of Old South Work, Boston); 'Address on War, containing True Grandeur of Nations,' 'War System of Nations', 'Duel between France and Germany' (Boston).

Marcus W. Jerden, Associate Professor of History, University of Chicago.

SUMNER, George Watson, American naval officer: b. Michigan, 31 Dec 1841. He was appointed to the Naval Academy in 1858. In the Civil War he participated in the bombardment of Forts Jackson and Saint Philip; commanded the Massasoit on the James River, and with the Onondaga forced the Confederate ironclads to relinquish the purpose of attacking Grant's transports and base of supplies at City Point, Va. After the war he served in various capacities, was commander of the naval station, Fort Royal, Va. C. (1899–1901); in January 1901 was appointed commandant of the Philadelphia navy yard.

SUMNER, Increase, American statesman: b. Massachusetts, 1746; d. 1799. He was graduated at Harvard College in 1767; admitted to the bar in 1770, and in 1779 was a member of the State Constitutional Convention. He was elected to Congress in 1782, a member of the United States Constitutional Convention in 1789, and in 1797 was elected governor of Massachusetts.

SUMNER, Samuel Storrow, American military officer: b. Pennsylvania, 6 Feb. 1842. He was appointed to the army from New York in 1861, served in the Civil War, and against the Indians in the campaigns from 1869 to 1878. In May 1898 he was appointed a brigadie general of volunteers under the command of General Miles, and when American War was assigned to duty in Cuba. He was ordered to England as military attaché, but left there in 1900 to join the United States troops in China. Later he was sent to the Philippines, where he was promoted brigadier general United States army in 1901, and major general, August 1903. His last service was in command of the Division of the Pacific, and he retired 6 Feb. 1906.

SUMNER, William Graham, American educator: b. Paterson, N. J., 30 Oct. 1840; d. 12 April 1910. He was graduated at Yale in 1863, studied abroad, was tutor at Yale in 1866–69, in 1867 took orders in the Protestant Episcopal Church, was assistant at Calvary Church, New York, and rector of church of the Redeemer, Massillon, N. J., appointed professor of political economy and social science at Yale College in 1872. His writings include a translation of Lange's 'Commentary on Second Kings' (1872); 'History of American Currency' (1874); 'Life and Andrew Jackson' (in 'American Statesmen Series' 1882); 'What Social Classes Owe to Each Other' (1883); 'Problems in Political Economy' (1884); 'Protectionism' (1885); 'History of Banking in the United States' (1896); 'Robert Morris' (1892).

SUMPTUARY LAWS, a term often used in American political discussion with reference to laws regulating the sale of liquor. The original meaning, however, was the regulation by law of eating and drinking, wearing apparel and style of living generally. The early settlers of New England adopted harsh laws of this character, which have been exaggerated and caricatured in the fictitious Connecticut *Blue Laws* of the Rev. Samuel A. Peters. Sumptuary laws existed in ancient as well as modern times. One such law or the Twelve Tables aimed at repressing extravagance in funerals. After the establishment of the censorship holding this office had the right of punishing those guilty of luxurious living. After the Twelve Tables the first sumptuary law passed at Rome was the Lex Oppia (215 B.C.), directed exclusively against the ex-
SUMTER—SUN

travagance of women in dress, jewelry, etc. This law was repealed 20 years later. The other sumptuary laws enacted at Rome were almost exclusively designed to keep down extravagance in entertainments. The *De Julia*, passed in the reign of Augustus, was the last sumptuary law passed at Rome, but a few endeavors were made under later emperors also to repress luxury by decrees of the Senate and imperial edicts. The last attempt of this nature that have been made belongs to the reign of Nero. Sumptuary laws were revived by Charlemagne. Both he and Louis the Debonnaire promulgated capitularies against luxury in dress and furniture. Various other laws and decrees having a like object were made under many of the later kings of France, even down to Louis XV. A royal ordinance, dated 19 April 1737, forbids the common people (*tulains*) the use of calico, which was reserved for the nobility, and there are instances of the wives and children of commoners being fined in virtue of this decree. In England sumptuary laws began to be enacted in the reign of Edward III, and continued to be passed down to the time of the Reformation. Most of them were repealed by 1640, but their use was not all expunged from the statute-book till 1856. Sumptuary laws in the early colonial period of America were not confined to New England. Directions were sent to Virginia in 1621 not to permit even the members of the council to wear gold in their clothes, or to wear silk till they make it themselves. In New England the Massachusetts magistrates prohibited the wearing of gold, silver or thread lace, all embroidery or needlework in the form of caps, bands or ruffles, gold and silver girdles, and other extravagances which offended Puritan simplicity. The laws were, however, ignored or but slightly enforced, and gradually became obsolete. At present in the United States dress is solely a question of decency, and sumptuary laws are, in that sense, of the past.

SUMTER, Thomas, American military officer: b. Virginia, 1734; d. 1 June 1832. After the capture of Charleston by the British in 1780 he took the field as a brigadier-general and on the 14th of May, 1781, he was one of the most active and able partisan leaders of the South. His bravery, endurance and unvarying cheerfulness and determination under reverses gained him from his followers the sobriquet of the Carolina game cock, and Cornwallis confessed that he was one of his greatest plagues. After gaining important successes over the British and Tories, he was, in September 1780, routed with considerable loss near the mouth of Fishing Creek on the Tarawa by Tarleton. In 1781 he took a distinguished part in the battle of Eutaw Springs. The thanks of Congress were tendered him in 1791, and he was afterward sent to that body as a representative of South Carolina. In 1809 he was appointed United States Minister to Brazil and two years later was elected United States senator.

SUMTER, S. C, city, county-seat of Sumter County, on the main line and several branches of the Atlantic Coast Line Railroad, 90 miles north of Charleston, is an agricultural region producing cotton, tobacco and vegetables, of which it exports large quantities. It also has manufacturing interests of importance which include cotton factories, planing mills, sash and blind factories, etc. There is a national bank and a State bank. The city has a public high school founded in 1889, and is the seat of Saint Joseph's Academy, a Roman Catholic school for girls, and of the Sumter Military Academy and Female Seminary, a coeducational non-sectarian school. Since 1913 the commission form of government administers city affairs. Pop. about 9,400.

SUMTER, Fort. See Fort Sumter.

SUMY, soo'më, Russia, a town in the government of Kharkov, on the river Psel, 81 miles north of the town of Kharkov. It has nine churches, a gymnasium, technical school, banks and a large sugar refinery, besides numerous distilleries. The soil is productive, and agricultural products are exported together with brandy. Four annual fairs give considerable impulse to trade. Pop. 51,500.

SUN, the great central body of the solar system. The aspect of the sun with which all are familiar from infancy shows that it is a shining globe. Astronomical measurements show that this globe is more than 140 times the diameter of the earth, and, therefore, more than 1,000,000 times its volume. Its small apparent diameter is due to its enormous distance of 93,000,000 miles. The following are more exact numerical particulars:

<table>
<thead>
<tr>
<th>Mean distance (miles)</th>
<th>92,900,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eq. hor. parallax</td>
<td>8.80'</td>
</tr>
<tr>
<td>Density (water = 1)</td>
<td>1.33</td>
</tr>
<tr>
<td>Mass (earth = 1)</td>
<td>332,000</td>
</tr>
<tr>
<td>Diameter (miles)</td>
<td>866,400</td>
</tr>
<tr>
<td>Gravity (earth = 1)</td>
<td>22.65</td>
</tr>
</tbody>
</table>

For methods of determining the distance and other quantities see ASTRONOMY, Theoretical.

The aim of the present article is to set forth the physical constitution of the sun, so far as modern research has made it known.

One of the most certain results of research is that the sun is at an extremely high temperature, higher than any that we can produce in our furnaces. This is shown by two considerations. One is the enormous amount of energy radiated, which suffices to support life on its surface, notwithstanding the immense distance at which it is placed. Nothing but a hot body could radiate so great a volume of energy. Another proof of the high temperature is shown by the spectroscopic, which discloses the vapor of iron and other refractory metals in the sun's atmosphere. It requires a hot furnace to melt iron. Much higher must be the temperature which would make it boil away like water. The temperature of the sun not only does this, but the fact that the spectral lines of iron are dark on a bright ground shows that the solar light emanates from a body yet hotter than the vapor of iron.

Aspect of the Sun.—We can see only the surface of the sun, not its vast interior. To distinguish the two, the shining region is called the *photosphere*. The latter presents to our view the appearance of a flat disc. The edge of this disc is called the *limb*. When seen without telescopic magnification, through a dark glass or other medium, the edge of the sun appears quite uniform, slightly shaded off at the limb. But when carefully examined with
the telescope, under good atmospheric conditions, the entire photosphere appears as a darkish background, sprinkled with brighter grains or nodules. These "rice-grains" are quite irregular in size and form, and appear as if bright on a relatively dark or yellowish background. It is probable that they are produced by currents of heated matter from the interior, hereafter to be described, which are constantly rising to the surface, there to radiate their heat and then fall back again. When the intensity of the heat radiated from different parts of the photosphere is accurately measured, it is found that the amount of radiation diminishes from the centre of the disc to the limb, where it is least. The diminution is slow at first, but increases quite rapidly at the limb, where it is little more than one-half of that at the centre. The light diminishes in a still greater ratio than the heat. The tint of the light is also different.

at the centre and at the limb, although this would hardly be noticed by the eye. The light at the limb has more red in its composition than at the centre. This effect is especially noticeable at the time of a total or annular eclipse of the sun. When the moon has nearly covered the sun, the remaining light has a lurid aspect, as if the sun were shining through a smoky atmosphere, thus giving to observers the illusion that the sky is hazy. There can be no doubt of the cause of this appearance. The sun, like the earth, is surrounded by an atmosphere; but this atmosphere is cooler than the photosphere which sends out the light and heat. The existence of the atmosphere is demonstrated by the lines of the spectrum, as well as by the absorption of heat at the limb, which is greater than near the centre because the light coming from that portion of the photosphere has to pass through a greater depth of the atmosphere than when it rises directly upward from the centre.

The Solar Spots.—When the Galilean telescope was first pointed at the sun, the observers were surprised to find that that object was now and then variegated by dark spots. These were observed by Galileo, Scheiner and Fabricius. The two latter published more or less elaborate treatises on the subject, but with their imperfect instruments they were not able to learn much as to the laws of these objects. We now know, with the modern perfected methods of observation, that the spots are of very different sizes, ranging from the minutest point visible in the telescope to a size so great as to be perceptible to the naked eye. The largest must, therefore, exceed the earth itself in diameter. These objects are usually very irregular in their outline, being frequently jagged and cornered, as if made by a shot or bunch of shot passing through a tin plate or wooden plank. They frequently appear in groups; indeed a spot visible to the naked eye commonly consists of a group of these objects close together. The spots of the group may run into each other to any extent, forming an irregular and jagged mass. Sometimes a spot has almost the appearance of a crack in the photosphere. In the spot two portions can generally be distinguished, a dark interior called the "umbra" and a shaded border, much brighter than the umbra, though not quite so bright as the photosphere, called the "penumbra." When the atmosphere is steady, the latter is seen, with a good telescope, to be not of uniform shade, but to be striated, presenting an appearance somewhat like that of a thatched roof. This can be seen better by a figure than by a long description. A spot seems black only by contrast with the brilliancy of the sun. If it were possible to cut off the sun's light, the light from the spot itself would be of dazzling brightness.

It was formerly supposed that the spots were openings in the photosphere, through which a darker interior was seen. This conclusion was reached because it was supposed that when
the spot approached the edge of the solar disc
the penumbra looked broader on the side of the spot
next to the edge. But careful observations
made in recent times show that this is not the
case, as great as the penumbra is broader at
one edge and sometimes at another. It was also
supposed that the spots might be something
in the nature of cooler dark metals floating on
the photosphere. But this view also has been
abandoned. It has recently been shown by Nic.
the sun spot as an enormous flux of ions which
whirling electrically charged particles produce
an intense magnetic field. Thus a sun spot
resembles a terrestrial tornado. The observations
of Evershed and St. John indicate that the
gases are rising from the interior of the sun
toward the surface, flowing nearly radially out
above the surface from the centre of the
spot. Measurements of the heat radiated from
the spot, as compared with that of the neighboring
disc, show that the spot is really cooler than
the rest of the photosphere. Spectroscopic ob-
servations agree with this by showing a great
absorption of the light coming from the interior
of a spot.

Another salient feature of the sun is its
rotation on an axis deviating only six degrees
from a line perpendicular to the ecliptic. The
time of rotation is shown by observations of
the spots on the sun, which we see to move
from east toward west. The relation of the
sun to its own axis of rotation is much the same
as in the case of the earth. The sun's axis inter-
sects the photosphere at two opposite points
called the poles of the sun. A circle passing
round the sun midway between the poles is
called the solar equator. Distances north and
south of the equator are called solar latitude.
When we look at the sun at noon its north and
south poles are near the upper and lower points
of the disc; and the equator passes horizontally,
or nearly so, across the centre of the disc. The
position of the sun's equator is more exactly
defined by the following numbers:

<table>
<thead>
<tr>
<th>Inclination to the ecliptic</th>
<th>7° 15'</th>
</tr>
</thead>
<tbody>
<tr>
<td>Longitude of the node</td>
<td>74° 29'</td>
</tr>
</tbody>
</table>

The earth in its annual course around the
sun passes through the line of the nodes about
3 June and 3 December of each year. At these
times the apparent paths of the spots across the
sun's disc are straight lines. At the interme-
ciate times they are more or less curved. In
March the south pole is slightly turned toward
us, and the paths of the spots are curved up-
ward. In September the reverse is the case.
We see only the north pole, and the paths are
curved downward.

Observations of the spots lead to the unex-
pected conclusion that the equatorial regions
of the sun rotate in less time than those nearer
the poles, although the distance they have to go
is greater. The sun is so much larger than the
earth that, although the time of rotation is more
than 25 times as long, yet the absolute linear
velocity of the rotation near the equator is four
times as great as that of the earth's rotation,
being very nearly one mile per second.

The observations of Carrington give the
period of rotation as follows:

| At the sun's equator | 24.9 days |
| At 30° of latitude   | 26.4 days |

The apparent time of rotation, as we see it,
is nearly two days longer, because the earth
has carried us forward in its annual motion
while the sun is rotating, and the spot has to
catch up to our direction before a rotation seems
complete.

The rotation of the sun can also be de-
termined by means of the spectroscope, through
this instrument enabling us to determine
whether a luminous body is approaching the
earth, or receding from it. In consequence of
the rotation, the photosphere on the east side
of the sun is continually moving toward us, and
that on the opposite side moving away from us.
The observations made by this method agree
with those made on the solar spots in giving a
period of about 25 or 26 days; but they are discordant
as to the variation with latitude. The angular motions in the different latitudes, found
by two observers with the spectroscope, Duner
and Adams, are as follows:

<table>
<thead>
<tr>
<th>Latitude</th>
<th>Spots (Carrington)</th>
<th>Spectroscopic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>14.6°</td>
<td>14.6°</td>
</tr>
<tr>
<td>11</td>
<td>14.9</td>
<td>14.3</td>
</tr>
<tr>
<td>15</td>
<td>14.12</td>
<td>14.28</td>
</tr>
<tr>
<td>21</td>
<td>13.90</td>
<td>13.76</td>
</tr>
<tr>
<td>30</td>
<td>13.65</td>
<td>13.64</td>
</tr>
<tr>
<td>45</td>
<td>13.10</td>
<td>12.56</td>
</tr>
<tr>
<td>60</td>
<td>11.99</td>
<td>12.78</td>
</tr>
<tr>
<td>75</td>
<td>9.34</td>
<td>10.86</td>
</tr>
</tbody>
</table>

It is a remarkable and interesting fact that
the velocities thus determined by the displace-
ment of spectral lines differ systematically when
the lines of different elements are chosen. Thus,
the values determined by Adams from the lines
of iron, calcium and hydrogen, are as follows:

<table>
<thead>
<tr>
<th>Solar Latitude</th>
<th>Iron lines</th>
<th>Calcium lines</th>
<th>Hydrogen lines</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.3°</td>
<td>14.65°</td>
<td>15.0°</td>
<td>15.2°</td>
</tr>
<tr>
<td>14.9</td>
<td>14.31</td>
<td>14.9</td>
<td>15.0</td>
</tr>
<tr>
<td>29.7</td>
<td>13.65</td>
<td>14.7</td>
<td>14.6</td>
</tr>
<tr>
<td>44.7</td>
<td>12.85</td>
<td>13.6</td>
<td>14.0</td>
</tr>
<tr>
<td>60.0</td>
<td>11.93</td>
<td>13.1</td>
<td>14.3</td>
</tr>
</tbody>
</table>

This difference agrees with much other evi-
dence on the same point in indicating that the
different elements effective in producing the
lines lie at different levels around the ball of
the sun.

The rotation of the sun must produce an
eLLipticity or bulging out of the equator, as in
the case of the earth. But this effect is so small
as to elude all astronomical measurement.
To all appearance the sun, notwithstanding its
rotation, is a perfect sphere.

Two very remarkable laws govern the solar
spots, one relating to their frequency, the other
to the region of the sun's disc on which they
are seen. We recall the fact of the sun having
north and south latitude as we have on the earth. The first peculiarity of the spots is that they are rarely seen at more than 35° to 40° of solar latitude, north or south. They are most numerous at about 15° latitude, and from that parallel grow less numerous both toward and from the equator. At the equator they are comparatively scarce. Thus we see that there are two zones of spots; one north and the other south of the sun's equator. The following table of the number of spots observed by Carrington in different zones of latitude illustrates the law:

<table>
<thead>
<tr>
<th>Limiting lat. of zones</th>
<th>Number of spots</th>
</tr>
</thead>
<tbody>
<tr>
<td>0° to 5°</td>
<td>471</td>
</tr>
<tr>
<td>5 to 10°</td>
<td>1,940</td>
</tr>
<tr>
<td>10 to 15°</td>
<td>2,922</td>
</tr>
<tr>
<td>15 to 20°</td>
<td>2,158</td>
</tr>
<tr>
<td>20 to 25°</td>
<td>1,083</td>
</tr>
<tr>
<td>25 to 30°</td>
<td>740</td>
</tr>
<tr>
<td>30 to 35°</td>
<td>303</td>
</tr>
<tr>
<td>35 to 40°</td>
<td>84</td>
</tr>
</tbody>
</table>

The other remarkable feature of the spots is their periodicity. At intervals of 11 years they are very numerous, while at the intermediate times they are comparatively scarce, never being with the facts half the time. It is found that the period is almost exactly 11 years 47 days. It was at one time supposed to be the same as the period of revolution of Jupiter, which is somewhat less than 12 years. Had such been the case we should have concluded that the spots were in some way produced by the action of that planet. But it is now proved that the period is more than six months less than that of Jupiter, and does not coincide with any other period known in the solar system. Its average duration is found to be 11.13 years; but it is subject to changes of a year or more. We, therefore, conclude that the cycle of change in the spots is due to a round of processes going on inside the sun itself. What these may be we have no means of determining.

The very careful series of photographs of the sun made at the Greenwich Observatory during the past 30 years show a singular law of variation in the spots with the 11-year period. After a space of two or three years, during which, as we have said, the spots are few and small, the first evidence of a renewal of activity is seen in the occasional appearance of a spot at an unusually high latitude, say 30° to 35° north or south. This may continue for several months, or even a year. Then the spots begin to be more frequent nearer and nearer the equator, while there are fewer beyond 30° of latitude. Finally, after three or four years, they become thickest of all, as we have said; in about 15° of latitude. About five years from the time when fewest are seen, they will be most numerous; then they will also be seen nearer the equator or even on the equator itself. After five years they begin to diminish rather more slowly than they increased, until they gradually seem once more almost to disappear. The years of minimum sun spots are 1839, 1900, 1911, etc. The years when they are most numerous were 1882, 1893, 1904, etc. But these dates are only approximate, as the intervals between the minima are not always exactly the same.

The Faculae.—Another curious feature of the sun is the occasional appearance of spots brighter than the rest of the photosphere. These commonly appear in bunches in the neighborhood of the spots, and derive their name from the Latin word facula, a torch. They follow a law similar to that of the spots not only in having the same period, but also in being most numerous where the spots are most numerous. But they are seen over a very much wider region of the sun's disc than the spots, sometimes, although rarely, near the poles of the sun.

A third feature of the sun associated with the spots and the faculae is known as the "prominences." These can be actually seen through an ordinary telescope only during total eclipses of the sun. But they may now be seen at any time, when the air is clear, by means of a powerful spectroheliograph. Like the faculae, they are commonly, but not always, found in the neighborhood of the spots, being seen from time to time all round the sun's limb. (See Eclipse.) They will be described more fully hereafter.

It is quite evident, from what we have said, that the spots, faculae and prominences are all results of one series of operations. This fact has been being verified by the spectrophotograph and especially by the spectroheliograph. This is an instrument invented by George E. Hale of the Mount Wilson Observatory, which enables a photograph of the sun to be taken by the light of a selected ray of the spectrum, and excludes all the other rays being cut off. A ray frequently used for the purpose is one emitted by calcium. When a photograph is taken with this ray, we have not a general photograph of the sun by its light, which is what the ordinary camera would give us, but a photograph in which no light is allowed to enter except that emitted by the vapor of calcium. A photograph thus taken is found to be extremely variegated, some parts of the sun's disc being much brighter than others. The interesting feature is that, in the general average, the brightest parts of the disc are those where the spots, faculae, and prominences are most numerous. But these bright patches may appear on any part of the sun. The general conclusion is that all the objects we have described are all produced by processes going on in the sun which result in the throwing up of great masses of calcium vapor. Having thus described what the sun is in a general way, and shown its appearances, we pass on to particulars respecting its constitution and surroundings. Our conclusions must be drawn step by step from the phenomena exhibited by the photosphere, combined with reasoning upon the laws of force and the properties of matter. A conclusion most easily reached is that the sun is not a solid body throughout. If it were, its enormous radiation of heat would result in the surface rapidly cooling off, so that, in a very short time, it would cease to emit light. Moreover, a study of the surface shows changes constantly going on incompatible with the idea of solidity. It follows that the heat radiated from the surface must be continually being supplied either by the rising up of hot material from the interior, or by radiation from within outward. It is the latter which is believed to be acting. For the material of the sun is probably transparent, and it is supposed that the enormous heat is absorbed and re-radiated as we pass outward from the center.
1. Prominences on the edge of the sun. Photographed during the total solar eclipse, in Algiers, 30 August 1905.
2. The corona of the sun during the total eclipse of 28 May 1900.
3. Calcium flocculi in the neighborhood of a sun-spot. Photographed with the spectro-heliograph, 19 October 1903, at the Yerkes Observatory.
1 The appearance of the corona during the total eclipse of 30 August 1905
2 Spectro-heliogram of the whole disk of the sun taken at the Yerkes Observatory, 12 August 1905
The absorption and re-radiation from successive layers is almost instantaneous, the velocity of transference approaching 180,000 miles a second.

In drawing our conclusions the intensity of gravitation on the sun must be borne in mind. It has nearly 28 times the force of gravity on the earth. A man of ordinary size would weigh two tons at the surface of the sun, and would, therefore, be instantly crushed to death by his own weight, were it possible for him otherwise to exist there. Consequently, the pressure to which the vapors of the sun are subject increases with enormous rapidity below the surface.

The average specific gravity of the materials composing the sun can be determined by astronomical theory with great exactness. It is known that the mean specific gravity is about 40 per cent greater than that of water, and one-quarter of that of the earth. It is doubtless much smaller than this at the surface, and, therefore, increases toward the centre. A calculation of the resulting pressure shows that near the centre the sun is produced by the enormous mass and gravitation of the matter composing the solar orb amounts to about 5,000,000 tons per square inch. This pressure is so far beyond any that we can produce at the earth's surface that we are unable to say what effect it would have upon matter.

Yet another unknown factor is the temperature of the interior. At no great distance toward the centre the temperature exceeds the powers of determination—it may even be 1,000,000°. As the highest temperature which it is possible to produce artificially probably does not amount to 12,000°, it is impossible to say what effect such a temperature would have upon matter. Thus we have two opposing causes: the one an inconceivable degree of heat, such that, were matter exposed to it on the surface of the earth, it would explode with a power to which nothing within our experience can be compared, and a pressure exceeding thousands of times any we can produce, tending to condense and solidify this intensely heated matter.

One thing which we can say with confidence as to the effect of these causes is that no chemical combinations can take place in matter so circumstanced. The distinction between liquid and gaseous matter is lost under such conditions. Whether the central portions are compressed into a solid, or remain liquid, it is impossible to say.

Modern research shows that the sun, as a whole, is a complex body, the various parts of which are in very different conditions. Beginning at the centre and passing outward, we have first the vast, invisible interior which forms the globe itself, and which our sight can never penetrate. Surrounding this interior is the visible photosphere, or seeming surface, which we see with the naked eye or the telescope, the appearance of which has been fully described. So far as necessary direct observation could show, this would be the whole of the sun when the sun is beyond the red envelope which hides the real sun to us at the earth, the darkness of the great night of the sun. But what we see is a bright envelope which hides a real sun the brightness of which we never see.

The earliest accurate observers of total eclipses with the telescope noticed that during the total phase red cloud-like masses were seen here and there projecting beyond the limb of the dark moon. Moreover, at the beginning or the end of the eclipse, it is found that these projections are connected with a red border extending round the sun. There is, therefore, an envelope which hides a real sun behind the red cloud-like masses which are seen and is invisible except during eclipses. Quite independent of this envelope is a bright effulgence which is seen during a total eclipse. These phenomena are fully described in the article Eclipse. The phenomena observed during the eclipse of July 22, 1878, are described in the article Eclipse.

The red envelope which rests immediately on the photosphere is called the "chromosphere." It is comparatively thin—so thin as to be almost immediately covered when the sun is totally eclipsed. Its nature was first made known by the spectroscope, which showed it to be composed mostly of hydrogen, helium, and calcium vapor. Its principal and lower parts differ in constitution. At the photosphere it comprises nearly all the substances which exist in the latter. This was shown in a very beautiful way by observations of the reversing layer, first made by Young at the total eclipse of 1870. The explanation of the phenomena there described is that the photosphere is hot enough to shine by its own light, and, being a gas, to give bright spectral lines. But the photosphere is so much hotter than the chromosphere that the latter is, in comparison, a cool gas which absorbs the spectral lines from the light radiated by the photosphere. The question of the density of the chromosphere and reversing layer, as its base is called, has given rise to very varied estimates.

The fact that the spectroscope shows bright lines as the last ray of true sunlight disappears at the beginning of a total eclipse shows that the gas from which these lines emanate must be so rare as to be transparent through a distance of thousands of miles. We are, therefore, justified in concluding that the gases of the chromosphere are extremely rare, and the same is probably true of the principal regions of the photosphere.

Among the most extraordinary phenomena exhibited by the sun are the mountainous elevations of the chromosphere, which we see as the red protuberances already described. These are of two kinds, the eruptive and the cloud-like. The latter present to us the appearance of vast clouds floating in an atmosphere of the sun. It seems certain, however, that they cannot be what they seem, because there can be no atmosphere there to support them. They are probably held up by an impulsion of the solar rays, which will be described presently. The eruptive prominences seem to be due to outbursts of intensely hot gases, mostly hydrogen, from the sun. These are thrown up with a velocity of several hundred miles per second, like immense mountains of fire. They sometimes rise to a height of many thousand miles, their ascent being doubtless aided by the impulsion of the solar rays; then they fall back again to the sun. The chromosphere and prominences can now be photographed in projection against the sun's disc with the spectrophotograph. When such photographs are made with the light of the red hy-
hydrogen line, they show great vortex phenomena, centering in sun spots and closely related to the vortices in the photosphere which constitute the spots themselves. See Plate III.

The violent forces seen in action in the chromosphere are in singular contrast to the soft white light of the corona. Much mystery still surrounds the constitution of the latter. It was supposed to be an atmosphere of the sun; but this view is rendered untenable by the fact that an atmosphere supported by its own weight would more than double in density for every mile, that it was nearer its base. It probably consists of exceedingly minute molecules of gaseous matter, similar to those which make up the tail of a comet, and possibly having some resemblance to the latter. The newly-discover-

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<tr>
<th>Washington</th>
<th>Mount Whitney</th>
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<tr>
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<td>1902-07</td>
<td>1909</td>
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<tr>
<td>44</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Mean value</td>
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<td>1.959</td>
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<td>62</td>
<td>113</td>
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<tr>
<td>1.925</td>
<td>1.921</td>
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Prior to 1905 the true value of the constant was in much doubt; numbers ranging from 1.76 to 4.19 were stated for it; and the average value 3.0 was frequently accepted. There can be no doubt that the value 1.95 is very near the truth, and this may be regarded as the best value now obtainable. It has been well established, however, especially by the recent work of Abbot, that this fundamental constant varies slightly and irregularly. In 1919 a solar station was established at Calama, Chile, at which it is planned to make constant measures of the sun's radiation for several years, in conjunction with observations, with a special view of ascertaining, if possible, the law of this variation, and its effects upon terrestrial climates.

The Sun's Magnetism.—In the year 1908, Prof. G. E. Hale of the Mount Wilson Observatory, from an examination of the spectral lines in sun spots, discovered that around each spot there is a more or less powerful magnetic field. A powerful field will double many of the lines of the spectrum; a less powerful one will widen them. A few lines were found triple in sun spots, and afterward these same lines were found to become triple in the laboratory when viewed along the magnetic lines of force. Thus the lines of sun spots near the sun's limb tend to become triple, while those from spots near the centre of the solar disc are doubled merely. In many cases a pair of sun spots quite near together are found to have opposite polarity, and while in general the polarity of spots in the southern hemisphere is different from that in the northern, many cases of exception occur. It has, however, been well established that the sun, like the earth, has a north and south magnetic pole; the inclination of the sun's magnetic axis has been determined, and the fact has been established that the magnetic pole is in slow rotation about the pole of the sun.

A curious relation is found by the study of magnetic storms on the earth. The latter consist in occasional perturbations of the magnetic needle, which are very irregular in their character and are felt over the whole globe. They
1 Solar prominence 80,000 miles high, photographed with the spectroheliograph on Mount Wilson
2 The chromosphere and prominences photographed in projection against the sun's disk, showing the hydrogen
vertices centering in sun-spots discovered at Mount Wilson
generally occur when there is an unusually bright aurora. Now, investigations show that the number of these disturbances follows exactly the period of the solar spots. During those years when the spots are most numerous magnetic storms are most frequent, and vice versa. The conclusion is that the sun spots and magnetic storms are due to the same cause. The sun’s spots can be due only to something going on in the sun, and it follows that there must be some emanations from the sun which produce magnetic storms. Modern investigations have not been able to detect or define these emanations, though they are supposed to be electrically charged particles, shot out from the sun, and drawn in around the magnetic poles of the earth, where they give rise to the aurora.

We have the strongest reasons to believe that neither the magnetic field of the sun as a whole nor the much more intense local fields in sun spots, produce any measurable magnetic effect at a distance of the earth.

Age and Duration of the Sun.—The greatest problem connected with the sun is suggested by modern science. Up to 100 years ago students and philosophers saw no reason why the sun should not continue to shed heat and light on the earth for an indefinite period without undergoing any change whatever. But toward the middle of the 19th century the laws of energy were developed and understood. These laws set forth that the radiation of heat always involves the expenditure of something called energy, and that the latter is necessarily limited in supply. It was also seen that the sun must be a hot body, and must lose all the heat it radiated. To make this subject clear, we must remark that what the sun really radiates is not properly called heat in scientific nomenclature; the more exact term is radiant energy. But this differs in no respect from what is radiated into a room from a hot fire. Radiant energy goes out from the fire and strikes the walls of the room, where it creates heat, and thus warms the walls. All the heat thus transmitted to the walls comes from the coal, although in its passage from the fire to the walls it passes through an intermediate stage called radiant energy. That the latter depends on the temperature of the body from which it is passed is shown by the striking experiment of making a large lens out of ice instead of glass. When the sun’s rays are concentrated on a point by passing through this mass of ice they will burn the substance on which they fall, as if they had passed through glass. We see, then, that however cold the space between us and the sun may be, all the radiant energy reaching us from the sun must come from a source in the sun limited in accordance of the earth.

If the sun were merely losing energy like an ordinary hot body cooling off, a very simple calculation will show that it would be so cooled off in the course of 3,000 or 4,000 years as no longer to radiate much heat. It is clear that such has not been the case. Yet the most careful study shows no possibility that it can be receiving any considerable part of its energy from any outside source. Moreover, the geologists assure us that the stratification of the rocks, and planets, in ancient phenomena associated with them, proves that the sun has been radiating heat to the earth at not much less than its present rate for hundreds of millions of years.

The only solution of the puzzle that was suggested until 1903 was based on the mutual convertibility of heat and motion. From the time that the theory of energy was developed it was known that when the motion of a material substance is arrested without any other effect being produced, heat is generated. For example, the waters of Niagara are warmed by about one-quarter of a degree Fahrenheit in striking the bottom of the falls. The blacksmith by hammering a piece of cold iron can make it hot, because the energy which he puts into the motion of the hammer is converted into heat when the latter strikes the iron. It follows that if bodies of any sort are falling into the sun, heat will be generated by the fall. Moreover, owing to the power of the sun’s attraction, such bodies may fall with great velocity; and the heat thus generated increases as the square of the velocity. Thus arose the first theory as to how the sun’s heat could be kept up. It was supposed that meteors were continually falling into that luminous, but further study showed it to be impossible that meteors could fall in such quantity as to have this effect.

Then it was suggested by Helmholtz and Thomson that if the sun were a gaseous body, as it is now supposed to be, radiating energy, the loss of the latter would continually be made up by the fall of its outer portions involved in the continual contraction of the sun through loss of heat. All bodies, and gaseous ones in a higher degree than any others, diminish in volume when they cool off. Accordingly, when the photosphere of the sun cools off, it diminishes in volume, grows smaller and falls down upon the mass of the sun below it. Careful calculation shows that if the sun contracted about 250 feet per annum, the energy thus generated would keep up all the heat which the sun radiates. An important addition to this theory was made by J. Homer Lane, who showed that if the sun contracted like a mass of pure gas it would continually grow hotter as it contracted. This is now known as Lane’s law. But there is a necessary limit to the quantity of heat which can thus be generated. If the sun has been thus growing smaller through long ages, there must have been a time when it filled the whole space now occupied by the solar system. What is more, the contraction must have been far more rapid the larger the sun was; because the force of attraction at the sun’s surface diminishes as the inverse square of the diameter of the sun. For example, when the sun was twice as large as it is now, this force was only one-quarter as great; consequently it would have to contract four times as much to generate a given amount of energy as it does now. Finally, exact computation showed that even on this theory there was still a limit to the existence of the sun too narrow to satisfy the demands of geology. It could not have been radiating heat for more than 50,000,000 or 100,000,000 years. Before that time it must, according to the theory, have been a gaseous mass filling the whole space now occupied by the solar system, which contracted and formed sun and planets, in accordance with the theory known as the *nebular hypothesis.*

It also seemed very improbable that the sun's
heat could have been at all constant for even
20,000,000 years; on the other hand, geologists
went hundreds of millions of years. Thus ap-
parently an irreconcilable contradiction was
presented to scientific investigators when in 1900
the discovery of radium began to put a new
face upon the fundamental theories of physical
science. We now know that there is an in-
mense amount of energy stored in the atom,
which is a very complex thing. With the so-
called *radioactive* substances, the atoms may
be broken up, the result of the process being an
element of lower atomic weight than the original
substance. And in this breaking up of the atom
a great amount of energy is liberated. Though
it has been known for many years that Helm-
holtz' theory was inadequate, whether a large
part of the sun's energy is of this sub-atomic
origin, we do not know, but it is reasonable to
suppose that it is. And it is only necessary to
suppose that a part of the energy of the atom
is in this way changed into heat energy to al-
most indefinitely prolong the life of the sun.

The most recent semi-popular but authen-
tic work is *The Sun* by C. G. Abbot (New
York 1911); this contains many references to
more extended works or detailed publications.
A larger and very important work is *Physik
der Sonne* by F. Poggendorf (Leipzig 1916).
Numerous papers will be found in the Proceed-
ings of the Royal Society, London, and in the

**Simon Newcomb.**

Revised by Eric Doolittle.

**SUN, Eclipses of the.** See ECLIPSE.

**SUN, Order of the.** See ORDERS (ROYAL)
AND DECORATIONS.

**SUN-BIRDS,** a large family (*Nectariniidae*)
of small insect-eating birds of the tropics of
the Old World, having elongated, slender and
wings of moderate size and the central tail-feathers usually prolonged beyond
the others. These birds occur in the Eastern
Archipelago, India and Africa. They take the
place of the humming-birds of the New World,
and in brilliant colors and habits much resemble these, but are far removed from them
in classification, the honey-eaters (*Meliphagi-
da*) being their nearest relatives. They are
constantly hovering about flowers seeking the
minute insects found within the petals and sip-
going the flower-juices, so that they have been
named suncreters or sugar-eaters, by French au-
thors. Some certainly eat fruits. The song is
sweet, but without any special characteristics, and in habits they are exceedingly lively, quar-
relsome and even pugnacious. The gaudy
plumage is chiefly confined to the male sun-
birds and depends for effect upon intensity of
color and not upon metallic or prismatic lustre.
The nests are built in the hollows of trees or
are placed in thick bushes. Some species (such
as *Nectarina lotenia* and *N. asiatica*) make
dome-like nests, which are suspended from the
extremities of twigs of bushes, and are covered
with cobwebs for the purpose of concealment.
As magnificent treatise upon these birds, while
colored plates, has been written by Shelley, en-
titled *A Monograph of the Nectariniidae*;
(London 1876-80). The name is sometimes
given to various other birds. Thus the sugar-
birds or banana-birds (qq.v.) of the West
Indies are often so called; and a large South
American bird, also called finfoot, for which
see HELIORNITHIDAE.

**SUN-BITTERN,** an extraordinary somewhat-rail-like bird of Brazil and Guiana (*Erythropilus*). It is about 16 inches long, body small and thin, neck long and slender, head like that of a heron, with a long, powerful
beak compressed at the sides and slightly
arched at the culmen; the plumage is mostly
variegated with bars and spots of many colors,
and it has the habit of spreading wings and
tail in courtship or on other occasions of ex-
citement, forming a rosette about its head and
neck fancifully compared to a "sunburst." It
is often made a pet by the Brazilians, who call
it peacock. A larger species (*E. major*) in-
habits Venezuela and Colombia. Their nearest
relative is the kagu (q.v.). Consult Newton,

**SUN CRACKS.** See Mud CRACKS.

**SUN-DANCE,** a ceremony performed, with
local variations, by authentic tribes including
the Mandan, Omaha, Pawnee Loup, Cheyenne, Arikara, Hidatsa, Blackfeet, Nez
Percé, Winnebago, Yankton, Santee and Kiowa.
It is held apparently at the full moon occurr-
ing at or next after the summer solstice, and
lasts from three to six days. The dance of the
wild sage also indicates the times for hold-
ing the ceremony, and all neighboring tribes,
whether friendly or not, are usually invited.
The dance begins at sunrise and ceases at the
following sunrise. As may be inferred from
the length of the festival, including the fasting
and purification of the devotees and other
preparatory acts, the actual sun-dance is
but the chief episode in a ritual comprising a
congeries of ceremonies. The motive or pur-
pose of the dance is to promote welfare through
the gratification of desires and wants and to
avoid ill-fare through the dispensing of hostile
agents. The devotee or sun-dancer indulges in
the ceremony to fulfill a vow, made by him
during the previous winter or season from vari-
ous motives, that he would make a prayer to the
dispenser of what he needs through an ap-
pel to the sun, to *Wakanda* (among the
Sioux). The Tetons call the ceremony by a
name which means *They dance looking at the
sun.* In it the moon is regarded as the repre-
sentative of the sun, hence the dancers gaze
at it just as they do at the sun. Among
the principal objects in the festival of the sun-
dance is the sun-pole or "mystery tree" (sym-
bol of the centre of the four quarters of the
heavens), the sacred tent of preparation erected
within the so-called camping-circle of the tribe,
wild sage, a sweet-smelling grass called *wach-
ogya* by the Tetons and the dancing-lodge.
Each devotee persists in having received a vision from the sun; but if at the
close of the ceremony no such vision has been
voiced, his resort is had to self-sacri-
ifice, which is called *vision-hunting.* One of
the characteristic forms of self-sacrifice is that
of having two wooden skewers inserted under-
neath strips of skin raised by slashing the
breast or back, to which stout thongs are made
fast, by which the devotee is drawn up and
fastened to the sun-pole, to which he remains
suspended until his weight, sometimes made
greater by having a buffalo-skull hung to his perambulated center to rend the skin, thus letting the devotee fall to the ground, usually in a faint; another may have a buffalo-skull suspended from thongs passing through raised strips of the skin on the back or breast, which is allowed to hang thus until the skin is nipped and the thongs are freed. Some men who do not intend to dance seat themselves near the sun-pole, and small pieces of flesh are cut out in a row from the shoulders of each; these are offered to the being represented by the sun-pole. Women do not savor themselves in the sun-dance, and self-torture and the shedding of blood are not practised in the Kiowa ceremony. Consult Catlin, G., 'North American Indians' (new ed., 2 vols., Philadelphia 1913); Lowrie, R. H., 'The Sun Dance of the Crow Indians' (New York 1915).

SUN-DEW, any herb of the genus Drosera, which is classified near the pitcher-plants and the roses. Several species are found in America. The flowers are very pretty, like that of the saxifrage, five-petaled, and borne at the top of a slender scape, in a bud which are bent downward, the blossom of each day surmounting the arch and facing the sky. They are white or purplish in color. Sun-dews grow in bogs or wet ground, the roots are poorly developed and yet the small plants thrive even in sphagnum; this is because they are flesh-eaters, and live on the nutrient obtained from such insects as they can catch on their foliage; the roots, therefore, serving principally to anchor the plants and supply the large amount of water needed. The leaves, varying in shape in the several species, from round to filiform, are covered thickly on the upper face with wine-red filaments having a glistening drop like dew at the tips. These are stalked glands, destined for a purpose as deadly as that of the tentacles of the octopus. The leaf blades of the Drosera rotundifolia, a common sun dew, are round, and are arranged in a rosette around the base of the flower-scape, the small green woman and approximating resting on the ground. In times of inaction the tentacles radiate in concentric circles and are tipped by their globular translucent glands, which sparkle with a viscid secretion exuded by them. But let a fly light on one of the glands and remain there, glued fast by the viscous fluid, and there is immediately a change in the state of things. In its efforts to release itself, the struggling insect is only besmeared more completely, chokes the organs of respiration and is ultimately smothered. In the meantime, the tentacles, disturbed by the fly, have become excited and have transmitted the stimulus to the other glands so that they all bend toward the tiny body, converging over it, and striving to touch it. They even shift the inert object toward the centre of the leaf-blade, so that the greatest number of tentacles may reach it. Such glands as succeed in touching the meat secrete an acid juice, with the addition of a ferment which is entirely similar to pepsin, and apply this secretion to the fly digesting it, as it were. The glands then absorb the flesh and blood of the meat, and also their own secretions. The tentacles straighten up, the undigested portions of the insect resting on the dry glands are blown away, and the glands soon begin to exude a fresh secretion again, and make themselves ready for a fresh victim. When a large insect is entangled, the leaf-blade itself folds inward slightly, so that a maximum number of tentacles may concentrate upon the food. D. filiformis has erect, very narrow leaves, and when an insect is caught by the glands, the leaves themselves bend toward it. In D. longifolia the leaf-blade enfolds the fly. Sun-dew glands respond by bending to repeated touches, although no object rests upon them. It is only nitrogenous food which is obtained by this digestive process; carbonic acid is assimilated from the air as by other plants. Consult Darwin, C., 'Insectivorous Plants' (1875; new ed., 1900).

SUN-DIAL, an hour-measuring instrument known from the earliest times to the Egyptians, the Chaldaeans, and the Hebrews. It is worthy of remark, however, that no ancient Egyptian sun-dials have been found. Those connected with Egyptian remains have been recognized as all of Greek origin. The Greeks adopted it from the Etruscans, and it was introduced into Rome during the First Punic War. One of the earliest types of sundial found in Egypt, and still in use there, consists of a palm rod set upright in the ground, with a circular arc around it set out with stones to mark the hours as the shadow of the rod traverses the circle. Another more primitive form still in existence in Egypt has a rod laid horizontally in a north-and-south direction on two forked uprights, a short distance above the supply of water in the east and west of the rod are placed two stones or pegs. When the shadow of the rod lies across the westerly peg the day's work begins; when it reaches the easterly peg the day's work is ended.

It was discovered in very early times that a vertical rod could not throw a shadow that would accurately denote time, and the correct inclination of such a rod or the stile of a sun-dial was evidently a matter of experiment before the Greeks furnished the mathematicians with the means of fixing the angle by calculation. This surmise is borne out by the various inclinations found in ancient dials. Some of these were constructed arbitrarily at 45°, an angle having no relation whatever to the latitude of its location.

The first historic sun-dial dates from about 1000 B.C. It was found in Rhodesia, and is believed to be of Semitic origin. Sun-dials are referred to in Grecian literature in 560 B.C., and a certain sun-dial is specifically spoken of as having been set up at Athens by the astronomer Meton in 433 B.C. It is said of the Turks that wherever they build a mosque they place a sun-dial. In China they are everywhere, and small ones which may be carried in the pocket are very common. The correct use of these portable dials depends, of course, upon their accurate orientation when reading them.

Sun-dials have been classified under three headings, according to their superficial form: spherical, cylindrical and plane. The spherical form is the most used; it consists of a hemispherical hollow cut into a rock or built up in that form, the flat of the hemisphere being horizontal. An upright rod was set in
the centre of the hemisphere, pointing to the zenith. The hour marks were cut into the hollow surface. A variation of this type was the cutting away of the front half of the hemisphere. This form of necessity can mark only the hours from 6 A.M. to 6 P.M. An old Roman dial is in the form of a spherical shell of which about two-thirds have been cut away, held upon the shoulders of a herculean figure. Cylindrical dials have the hollow in the shape of a semi-cylinder cut through lengthwise. A rod in the position of the axis of the cylinder throws the shadow. A variation of this form is a semi-cone cut through its axis. The plane dials are too well known to need description.

In the placing of sun-dials another classification comes into play; they may be horizontal or vertical. Many of the latter type are set into or carved upon the walls of churches or other buildings or on stone blocks set upon pillars or pedestals. As a rule, the vertical sun-dials are set to face directly south. Where this is not feasible the gnomon may extend toward the south at the angle of a corner of a building, the hour lines being partly on one façade and partly on the other. In some of the odd pillar types the stone block at the top is cut with many facets like a crystal, with a gnomon on each facet.

The leading principles of dialing may be made intelligible to general readers by the following simple illustration:

Let $PB$, $PD$ represent the earth as a hollow transparent sphere, having an axis $PE$, of the shadow of the axis to fall on the hour on the plane $DCBA$. This diagram has been drawn for the latitude of Glasgow, $55^\circ 52'$, and the plane in its present position would form a horizontal dial for that place; but we may suppose it capable of moving round its axis $AC$, so as to assume different positions in the sphere. If it move round so as to become vertical, that is, at right angles to its position in the figure, we then obtain an erect south dial. The plane may also be made to incline from the meridian either toward the east or west. Thus we have dials of different kinds dependent on the position of the plane with regard to the first meridian, the position of the hour lines of which are all determined by the meridians of the sphere cutting the plane.

We have been considering the earth as the sphere, in our illustration of the nature of dials, but the earth's magnitude is so small compared with the distance of the sun, that no appreciable error will follow in considering a small glass sphere similar to that above described, but placed on the surface of the earth with its axis parallel to that of the earth; then will the sphere show the hour of the day in the manner before specified. The only things absolutely essential for a dial are the axis and the plane, the places of the hour lines having been once determined. Dials may have various forms, many of which are exceedingly curious and intricate, and require for their construction the application of complicated trigonometrical formulas. We shall confine our attention here to the most common, and, at the same time, most useful form, that is, the plane horizontal dial. On the proposed plane, which may be either of marble, slate or brass, draw a straight line $PHS$ for the meridian or 12 o'clock line, and parallel to this draw $12, H, S$, leaving a space between them equal to the thickness of the gnomon.

The gnomon is a thin triangular plate of metal, somewhat similar in shape to the figure $AEB$, the side $AB$ being fixed into the plate of the dial, so that the gnomon shall stand perpendicularly, the line $AE$ being directly north and south.

The line $AE$ is called the style, and the angle $EAB$ is made equal to the latitude of the place for which the dial is constructed. In the case of a vertical dial the angle $EAB$ must be the complement of the latitude, the
line A B the top of the gnomon and the line B E affixed to the dial.

We return again to the consideration of Fig. 2. Draw 6 H 6 perpendicular to 12 H S, and it will be the six o'clock hour line; make the angle 12 H F equal to the latitude of place, and draw 12 F perpendicular to F S, having 12 F equal to 12 F. The line 12 1 2 3 4 is drawn parallel to the line 6 H 6. From the point P draw the lines P 1, P 2, P 3, etc., terminating in the line 12 1 2 3 4, making angles with the line 12 P at the point P of 15°, 30°, 45°, etc., increasing by 15° each line. Next from the centre H draw the lines H 1, H 2, H 3, etc., and thus the hour lines of 1, 2, 3, 4 and 5 P.M. will be found. The hour lines on the other side of the style should now be formed by taking a tracing of the side already formed; the hours are of course numbered differently, and both sides will stand thus, the hour line of both sides corresponding:

1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12.

Here we have carried the hours beyond 6, which was the extent of the construction but found the hour line for 4 and 5 in the morning we have only to produce the hour lines of 4 and 5 in the evening, and in like manner for the hour lines of 7 and 8 in the afternoon, produce the hour lines of 7 and 8 in the morning. The dial gives solar time, and, therefore, the time, according to it, will only agree four days in the year with a well-regulated clock. See Equation.

The orientation of the sun-dial after it is made is a necessity of the first importance if satisfaction is desired. This process is carried out usually at night with the aid of two plum lines one north and the other south of the position in which the dial is to be set. From the Nautical Almanac the time is found at which the polestar crosses the meridian of the place. The two plum lines are brought into a line pointing to the star at that moment. The dial can then be placed in the same line conveniently by daylight. It is usual to erect frames of considerable height to hold the plum lines so that the sighting upward may be the easier. If the location of the pedestal of the dial is chosen beforehand, the frames for the plum lines must be so arranged that both may be moved so as to have the centre of the pedestal in the same line with them and the star.

The sun-dial is daily getting more rare in this age but notwithstanding the superiority of the clock, why has the dial almost everywhere vanished? "If its business use," as has been well observed, "be superseded by more elaborate inventions, its moral use, its beauty, might have pleaded for its continuance. It spoke of moderate labors—of pleasures not protracted after sunset—of temperance and good hours. It was the primitive clock—the horologe of the ancients. Age has not missed it in paradise. It was the measure appropriated for sweet plants and flowers to spring by— for the birds to apportion their silver warblings by— for flocks to pasture and be led to fold by. The shepherd carved it out quaintly in the sun, and, turning philosopher by the very occupation, provided it with mottoes more touching than tombstones."

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SUN-DOG: also called Mock-Sun and Parhelion. In meteorology, a bright, luminous area sometimes seen on either side and at the same altitude as the sun. Sun-dogs are found at the points in which the solar halos cut the horizontal, parhelic circle. Thus two sun-dogs are usually seen on either side of the sun, and at equal distances from it, though four are not infrequent. The nearer pair are 22° from the sun and the outer are 46° distant, while fainter sun-dogs are more rarely seen at 50°, 98° and 120°, and even directly opposite the sun. The last is sometimes known as an Anhelion.

Bright areas formed at the intersections of any two circular halos near the sun are sometimes also referred to as sun-dogs and such sometimes are seen directly above and below the sun. The parhelic circle is produced by the reflection of the sun's light from ice prisms or snow crystals whose axes lie in a vertical position — so-called 'Contract Arches' arise from prisms whose axes are horizontal. It is the latter that give rise to sun-dogs which are vertically above and below the sun.

Sun-dogs are usually reddish on the sides toward the sun and they are sometimes greatly elongated along the parhelic circle which produces them. They vary greatly in brightness and distinctness with the variation of the number and arrangement of the ice crystals in the air.

SUN AND LION, Order of, a Persian order founded in 1808 by Shah Path Ali, in imitation of the French Legion of Honor, established about six years previously by Napoleon I, then first consul. It includes five classes.

SUN MOTOR. See Solar Motor.

SUN WORSHIP, a form of nature worship which prevailed in all the ancient civilizations. In numerous primitive religions the sun is not the supreme deity; in many the moon holds the pre-eminence. The mode of reckoning time by moons is more ancient than solar calculation: in the language of the Hottentots, just as in Teutonic, the Moon is hehe, the Sun she she; and rude tribes in both hemispheres still make the moon masculine, the sun feminine: the ancient Germans used to say Hermon (Herrmond, Lord Moon) as the Germans still say Herrgott: on the other hand, as a medieval writer tells us, the sun used to be called Holy Lady: "I knew an old woman who believed the sun to be a great scarce, calling her son its doxling." The aborigines of North America worship the sun; for them the peace-pipe is the gift of the sun; in the council the pipe is always passed.

"Horae non numero nisi sermone" ("I count not the hours unless they be bright") was an ancient dial motto of great beauty and significance.
around, following thus the sun’s course. The Natchez lived under a monarchy and the royal family, children of the Sun, like the race of the Incas of Peru, stood high above the common people. In Mexico the sun was pre-eminent over all the other gods. In the Hebrew sacred books there are solemn denunciations of sun worship, for the heathen all around paid adoration to the luminary; and it is clear from 2 Kings, 5: 19, that some of the kings both of Judah and of Israel favored the worship of the sun.

SUN-YAT-SEN, Chinese revolutionary leader: b. Fatshan, near Canton, 1866. He was graduated (1902) at Hongkong School of Medicine, and started practice at Macao when he became one of the plotters resolved on forcing the Manchu dynasty from power. He fled from Canton after the first failure at revolt and went to Japan, thence to San Francisco. He formed the revolutionary association Kao Lao Hwei and carried on his propaganda all over the world, making the United States his headquarters and domicile. Dr. Sun’s life was jeopardized by the standing reward of $50,000 for his assassination, but the revolution of 1911 in China succeeded, thanks largely to his indefatigable energy and resourcefulness in propagating the work in every country. He was rewarded by being made Provisional President of the new Chinese Republic but resigned in 1912 in favor of Yuan Shih-kai in order to be the dominant influence of the latter into the cause. Sun’s later opposition to Yuan Shih-kai in the Peking Parliament caused his expulsion and he had to flee to Japan. Consult Cantile and Jones, ‘Sun-Yat-Sen, and the Awakening of China’ (3d ed., New York 1913).

SUNBURN (erthema solare or eczema solare), an injured condition of the skin caused by exposure to the action of the heat of the sun’s rays. The resulting conditions vary according to the degree of elevation of the temperature, the character of the medium through which its effect is exerted, length of time the skin is subjected to the action. The effect is productive of an erythematous redness, skin slightly tumified (swollen), with sensation of burning heat. In its course the skin usually desquamates (scales off) and becomes the seat of a “dirty-brownish stain,” which passes off later. Such a condition is brought about by several hours’ exposure of the bare skin to the sun’s rays. Under severe conditions of temperature blistering may arise at times. In the former, ordinary cases a lotion or salve excluding the air from the injury, and to relieve the pain, is applied. Zinc oxide, boric acid, vaseline, etc., are recommended. In severer cases excision arising the same treatment must be used as in scalds or burns.

SUNBURY, sôn’bû-rî, la., borough, county-seat of Northumberland County, on the Susquehanna River, and on the Pennsylvania and the Philadelphia and Reading railroads, about 157 miles north of Philadelphia and 55 miles north of Harrisburg. It was settled in 1772 by Rev. General Lukens and William Maclay. It was incorporated as a borough 24 March 1797. The place was once the site of the Indian village of Shemokin. In 1756 Fort Augusta was erected here as a means of defense against the French and Indians. The city is in a lumbering and coal region. The chief manufacturing establishments are railroad shops, planing mills, silk mills, dye works, sash and door factories, nail factories, a rolling mill and coffin and casket works. It is an important commercial and industrial centre for a large region; extensive coal shipments are made from here. The principal public buildings are the county courthouse, municipal buildings, the Mary M. Packer Hospital, the churches and public schools. The three banks have a combined capital of $500,000. The government is vested in a chief burglar, a council of 16 members, who hold office two years. A small stream separates Sunbury and East Sunbury; the boroughs are one in industrial and commercial interests, but have independent municipal governments. Pop. about 16,000.

SUNDA (sûn’da) ISLANDS, a group of islands in the Indian Ocean, comprising three minor groups, namely, (1) the Great Sunda Islands, to which belong, Sumatra, Borneo, Celebes, Java, Madura, Banka and Billiton; (2) the Lesser Sunda Islands, comprising nine islands of smaller extent, forming the Sunda Group, all forming part of the Malay or East Indian Archipelago. The flora is exceedingly rich and varied. This is the home of sugar-cane and many of the spices, and the different altitudes from coasts upward produce an exceptional variety of plant-life. Some districts, as in Sumatra, reach high elevations, others consist chiefly of grassy plains, or forest-covered slopes.

SUNDA STRAIT, East Indies, the channel which separates the island of Java from Sumatra. It is from 20 to 100 miles wide, and contains a number of volcanic islands, the most noted of which is Krakatao (q.v.). The strait is an important commercial channel.

SUNDERBANS, soon’där-bânz, or SUNDERBHUNDS, soon’dër-bûn’dz, India, the alluvial islet region lying around the mouths of the Ganges River (q.v.), and forming the lower part of the delta. It stretches for 175 miles along the coast, and has an area of 8,000 square miles. The region is intersected by a network of innumerable channels and backwaters, many of which are navigable. The intervening islands are largely marshy, and covered with dense forest jungle abounding in wild animals, snakes, crocodiles, tigers and leopards. The unhealthy climate has hitherto defeated all attempts at reclamation.

SUNDAY, William Ashley, American evangelist: b. Ames, Iowa, 19 Nov. 1863. He was educated at the high school, Nevada, Iowa, and studied at Northwestern University. From 1883–90 he was a professional baseball player in the Chicago, Pittsburgh and Philadelphia teams of the National League. He became assistant-secretary Y. M. C. A at Chicago (1891–95) and started his career as evangelist in 1896. In 1903 he was ordained a Presbyterian minister by the Chicago Presbytery. He has held evangelistic meetings in many of the cities of the United States, drawing large audiences and securing great numbers of converts.

SUNDAY, the Christian weekly festival, by theologians associated with the Jewish Sabbath
SUNDAY

(see SABBATH), while its observance is often enforced by the citation of the Fourth Commandment in the Decalogue. While the Christian Church has never identified Sunday with the Jewish Sabbath, it has always quoted the Fourth Commandment as sanctioning, if not enacting, rest and relaxation from labor in one day out of every seven. When the Church was made a department of civil state by the Christian emperors of Rome, the observance of Sunday was enforced by civil statute. When the Roman Empire passed away, and the office of pontifex maximus, once held by the emperor of Rome, was claimed by the bishop of Rome, Sunday observance was enforced by ecclesiastical as well as civil law. The Third Council of Orleans 538 forbade all rural work on Sunday. Pope Gregory I made at Rome the same law as had been passed in 578 by the Council of Auxerre:

"On the Lord's Day it is not permitted to yoke oxen or to perform any other work, excepting for approved reasons." Charlemagne in 813 enacted that on the Lord's Day all servile labor should be abstained from. What that meant in practice is shown by what was done in England during the Saxon monarchy up to the time of Edward the Confessor (whose Sunday law is dated 1056), abstention from marketings on Sunday and from popular meetings was enforced under penalty of a fine. Equally strict was the Sunday legislation which followed the Norman Conquest. The mediæval Sunday laws in England were but the expansion of the Saxon laws. In 1281 a.d. John Peckham, archbishop of Canterbury, explained the Fourth Commandment as follows:

"In the commandment 'remember that thou keep holy the Sabbath day,' Christian worship is enjoined, to which laymen as well as clerks are bound; and here we are to know that the obligation to observe the legal Sabbath, according to the form of the Old Testament, is at an end, together with the other ceremonies in that; to which in the New Testament hath succeeded the custom of spending the Lord's Day, and other solemn days appointed by the authority of the Church, in the worship of God; and the manner of spending these days is not to be taken from the superstition of the Jews, but from the canonical institutes."

A statute of the 26th of Edward III runs as follows: "Item, it is accorded and established, that showing of woolls shall be made at the stable every day of the week, except the Sunday and solemn feasts of the year."

In 1359 a.d. Islep, archbishop of Canterbury, issued the following to his clergy: "Whereas, the most excellent prince, our lord, the King of England, is now going to make an expedition in foreign parts with his army for the recovery of his right, exposing himself as a soldier to the doubtful event of war, the issue whereof is in the hand of God; we who have hitherto lived under his protection are, by the divine favor shining on us, admonished to betake ourselves to prayer, as well for the safety of every one of his men as for the safety of our own person; and as a golden opportunity of doing us good fortune should invade us (which God forbid), our confession and reproach should be the greater. But, though it is provided by sanction of law and canon that all Lord's days be observed, as the Christian race, that neither markets, negotiations or courts, public or private, ecclesiastical or secular, be kept, or any country work done on these days, yet we are clearly to our heart's grief, informed that a detestable, nay, damnable perverseness has prevailed, insomuch that in many places markets not only for victuals, but other negociations (which can scarce be without frauds and deceit), unlawful meetings of men who neglect their churches, various tumults and other occasions of evil the Christian emperors of Rome, the observance of Sunday was enforced by civil statute. When the Roman Empire passed away, and the office of pontifex maximus, once held by the emperor of Rome, was claimed by the bishop of Rome, Sunday observance was enforced by ecclesiastical as well as civil law. The Third Council of Orleans 538 forbade all rural work on Sunday. Pope Gregory I made at Rome the same law as had been passed in 578 by the Council of Auxerre:

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Lord, or on the feast of Corpus Christi to command or cause to be sold, or place or put on any one's feet or legs, any shoes, hose or galoches, under the penalty of the forfeiture of their souls and a fine of ten shillings for every offense; a third part to go to the king, a third to the governors of the guild (mestier) of cordwains, and the residue to the informer. In 1523 this act was repealed by Henry VIII (1509-1547).

On coming to the throne in 1547, Edward VI issued the following injunctions: *Whereas in our time, God is more offended than pleased, more dishonored than honored, upon the holy day (Sunday), because of idleness, pride, drunkenness, quarrelling and brawling, which are most used in such days; people nevertheless persuading themselves sufficiently to honor God on that day if they hear mass and service, though they understand nothing to their edifying; therefore all the king's faithful and loving subjects shall from henceforth celebrate and keep their holy day (Sunday) according to God's holy will and pleasure, that is in hearing the Word of God read and taught, in private and public prayers, with thanksgiving, showings of offenses to God, and amendment of the same, in reconciling themselves charitably to their neighbors, where displeasure hath been, in oftentimes receiving the communion of the very body and blood of Christ, in visiting the poor and sick, and in using all soberness and godly conversation.*

Elizabeth put forth the following injunction touching Sunday: *All the queen's faithful and loving subjects shall, from henceforth celebrate and keep their holyday according to God's will and pleasure; yet notwithstanding, all parsons, vicars and curates shall teach and declare unto their parishioners, that they may with a safe and quiet conscience, after their common prayer in the time of harvest, labor upon the holy and festival days, and save that thing which God hath sent . . . in every parish three or four discreet men, which tender God's glory, and his true religion, shall be appointed by the ordinaries diligently; and that no parishioner duly resort to their church upon all Sundays and holy days, and there to continue the whole time of the godly service; and all such as shall be found slack and negligent in resorting to the church, having no great or urgent cause of absence, they shall straightly call upon them, and after due admonition if they amend not, they shall denounce them to the ordinary.*

Under the Puritan influences attempts were made to bring about a too strict observance of Sunday. To counteract this Charles I republished an injunction issued by his father, James I, in which he declared: *As for our good people's liberty and religion, we do hereby declare it is, that after the end of divine service our good people be not disturbed, letted or discouraged from any lawful recreation, such as dancing, either men or women, archery for men, leaping, vaulting or any other such harmless recreation, or for playing at any sport, music, morris dances, and the setting up of May poles and other sports therewith used; so as the same be had in due and convenient time without impediment or neglect of divine service; and that women shall have leave to carry rushes to church for the decorating of it, according to their old custom. But withall we do here account still as prohibited all unlawful games to be used on Sundays, only as bear and bull baits, interludes, and at all times in the meaner sort of meals on the day aforesaid.*

The act of Charles II (1670) was the law of the American colonies up to the time of the Revolution, and so became the basis of the American Sunday laws. It runs as follows: *For the better observance of holy the Lord's day, commonly called Sunday: be it enacted by the king's most excellent Majesty, and by and with the advice and consent of the lords, spiritual and temporal, and of the commons in this present Parliament assembled, and by the authority of the same, that all the laws enacted and in force concerning the observation of the day, and repairing to the church thereon, be carefully put in execution; and that all and every person and persons whatsoever shall upon every Lord's day apply themselves to the observation of the same, by exercising themselves thereon in the duties of piety and true religion, publicly and privately; and that no tradesman artificer, workman or other person or persons entertaining any worldly labor or business or work of their ordinary callings upon the Lord's day, or any part thereof (works of necessity and charity only excepted), and that every person being of the age of fourteen years or upwards offending in the premises shall, for every such offense, forfeit the sum of five shillings; and that no person or persons whatsoever shall publicly cry, show forth, or expose for sale any wares, merchandise, fruit, bread, goods or chattels whatsoever, upon the Lord's day or any part thereof, upon pain that every person so offending shall forfeit the same goods so cried or showed forth or exposed for sale. And it is further enacted that no drover, horse-courser, waggoner, butcher, higgler — they or any of their servants shall travel or come into his or her inn or lodging upon the Lord's day, or any part thereof, upon pain that each and every such offender shall forfeit twenty shillings for every such offense. And that no person or persons shall use, employ, or travel upon the Lord's day with any boat, wherry, lighter or barge, except to be upon extraordinary occasion to be allowed by some justice of the peace of the county, or some head officer, or some justice of the peace of the city, borough or town corporate, where the deed shall be committed, upon pain that every person so offending shall forfeit and lose the sum of five shillings for every such offense.*

The Lord's day legislation of Cromwellian days was as distinct and detailed as a fragment from Leviticus, as is shown in the following extract from an act of Parliament dated 1656: *Every person grining or causing to be ground any corn or grain in any mill, or causing any fulling or other mills to work upon the day aforesaid; and every person working in the washing, whiting or driving of clothes, thread or yarn, or causing such work to be done, upon the day aforesaid; every person setting up, burning or branding beasts upon the day aforesaid; every person gathering of rates, loans, taxations or other payments upon the day aforesaid (except to the use of the poor in the public collections); every chandler melting, or for that purpose using, wax belonging to his calling; and every common
brewer and baker, brewing and baking, or causing bread to be baked, or beer or ale to be brewed upon the day aforesaid; and every butcher killing any cattle, and every butcher, c offermonger, poulterer, herb seller, cordwainer, shoemaker or other person selling, exposing or offering to sell any of their wares or commodities, upon the day aforesaid; all tailors and other tradesmen, fitting or going to fit, or carry any wearing apparel or other things; and baker, bakers, runnemen, persons keeping, using or being present upon the day aforesaid at any fairs, markets, wakes, revels, wrestling, shootings, leaping, bowling, ringing of bells for pleasure or upon any other occasion (saving for calling people together for the public worship), feasts, church ale, May poles, gaming, bear-baiting, bull-baiting, or any other sports and pastimes; all persons unnecessarily walking in the church or church-yards, or elsewhere in the time of public worship, and all persons vainly and profanely walking, on the day aforesaid; and all persons traveling, carrying burthens or doing any worldly labor or work of their ordinary calling on the day aforesaid, shall be deemed guilty of profaning the Lord’s day.

In the 17th century a number of dissenters fled from England and reached America in 1620, and settled at New Plymouth. In 1629 another band from England joined them. Thus the establishment of Puritanism in America. The theocracy of the Hebrews furnished the model after which their civil government was constituted. Their idea of Sunday was summed up in the enactment of 10 June 1650, passed by the Plymouth general court: Further be it enacted, that whosoever shall profane the Lord’s day by doing any servile work, or any such like abuses, shall forfeit for every such default ten shillings, or be whipped.

Profanation of the Lord’s day included traveling, loitering at the door of a meeting house, drinking in an inn, staying at home instead of attending church and it was also enacted by the court, that “if any in any lazy, slothful or profane way doth neglect to come to the public worship of God, shall for be forfeit for every such default ten shillings, or be publicly whipped.

In Massachusetts the laws were equally strict.

In 1716 Sunday desecration appears to have been on the increase, since we are told: “Many persons do presume to work and travel on the said day” so that the authorities saw it fit to increase the penalty for “working or playing” to 10 shillings, and that for traveling to 20 shillings for the first offense. For the second offense these fines were doubled and the parties made to give sureties for good behavior in the future. A month’s continued absence from the public Sunday services was also made punishable by fines of three hours in the stocks or cage. In 1727, the fine for “working or playing” was increased to 15 shillings, and that for traveling to 30 shillings for the first offense, and for the second, three pounds. If the offender failed to pay the fine, the offender to be imprisoned in the county jail not to exceed five days. At this time, also, funerals, since they induced “great profanation of Sunday, by the travel and passing of children and servants in the streets, were prohibited, except in extreme cases, and then under license from a civil officer of the town. The director of a funeral transgressing this was to be fined 40 shillings, and the sexton or grave-digger 20 shillings. Shors for the retailing of strong drinks were also to be searched by the proper officers, and if any were found there drinking, the proprietor and the drinker were each to pay five shillings.

In 1760 all former laws relative to Sunday gave way to a new code, the provisions of which were as follows: Work or play on land or water, is fined not less than 10 nor more than 20 shillings. Traveling by any one except in extremity and then only far enough for immediate relief, is liable to the same penalty. Licensed public-house keepers are forbidden to entertain any except travelers, strangers and lodgers in their houses or about their premises, for the purpose of drinking, playing, lounging or doing any secular business whatever, on penalty of 10 shillings; the persons lounging, etc., also paying not less than five shillings. On the second conviction the innkeeper is made to pay 20 shillings and on the third offense to lose his license. Loitering, walking or gathering in companies in streets, fields, orchards, lanes, whatsoever is prohibited on pain of five shillings fine; and on a second conviction the offender is required to give bail for future obedience. Absence from public service for one month is fined 10 shillings. No one is to assist at any funeral, not even to ring a bell, unless it be a licensed funeral, on penalty of 20 shillings fine. In Boston, however, a funeral might be attended after sunset without a license. The observance of the Sunday was to commence from sunset on Saturday. Twelve wardens were appointed in each town to execute these laws; these were to look after all infringements, enter all suspected places, examine or enquire after all suspected persons, etc. In Boston they were to patrol the streets every Sunday (very stormy or cold days excepted), and diligently watch and search for offenders. In case any one convicted on any point in this code failed to pay his fine at once he was to be committed to the common jail, not less than five, nor more than 10 days. These laws were to be read at the March meeting of the towns each year.

Practically all the States of the American Union have laws prohibiting Sunday work; but these laws are practically a dead letter. In Arizona and California, however, there are no special Sunday laws. In all other States there are laws, in one form or another, providing for the Sunday-closing of saloons and general places of business, exclusive of drug stores, restaurants and businesses of prime necessity to the general comfort of the community. These laws are pretty generally observed. In some places even harbor shops are closed.

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SUNDAY CONSTABLE. See Town and Town Meetings.
SUNDAY SCHOOLS, meetings or gatherings in which religious instruction is given to children and young people, usually orally and on Sundays. Such schools are sometimes also known as Bible classes, because the Bible is the textbook in frequent use and often the Bible and the Christian doctrine lessons are arranged in a catechetical form and hence are the name of the textbook used, catechism, which is sometimes applied to the class or school itself as such a book. More commonly, however, a Bible class is one of a series of classes in a Sunday school, frequently being a class for adults and older scholars. The work of teaching religion to classes or in schools was practised in very ancient times (Gen. xiv, 14) and by the ministers of God, or their appointed assistants, whenever conditions were such that the young were not taught in their own homes (Deut. xxxi, 10-13). The study of the law was of obligation; religious schools existed in connection with the synagogues. The catechetical method was at first in general use.

Early Christian Doctrine Schools.—The apostles, or certain persons appointed for the work of giving instruction to the catechumens. The religious school, among Christians, seems to have had first place; before the books of the Bible were collected as they now exist, the life of Christ had been taught orally. As Christianity extended and schools came under the control of the Christians as nearly all the teachers were Christians, so the religious instruction became a part of the regular work of the school. The differences which arose at the time of Luther (q.v.) led to the establishment of classes and schools for teaching the religious beliefs of different churches. In many cases the religious teaching was continued in the schools and the new classes formed were for the poor and those, both young and old, who were not well instructed. Luther and his followers established such schools. Saint Charles Borromeo (q.v.) was one of the most zealous in founding Sunday schools in all parts of his archdiocese of Milan. He succeeded in arousing the enthusiasm and in securing the cooperation of the laity, men and women, so that he had a large number of teachers. In order to unite the workers and furnish a means of training them for the work, he established an organization called the "Confraternity of Christian Doctrine." Besides the teachers who were members of this Confraternity, there were also others, who were called Fishers, whose duty was to gather the children and the ignorant and bring them to the places appointed, on Sundays or on week days. At the death of Saint Charles there were in his diocese alone nearly 4000 members of the Confraternity. They taught in 740 Sunday schools and had over 40,000 pupils. Those receiving religious instruction in the regular schools were not included in this number. This Confraternity still exists. In England there is a large membership. It was introduced into the United States in 1902 and established in the archdiocese of New York by the Roman Catholic archbishop, Michael Augustine Corrigan.

Modern Sunday Schools.—Robert Raikes (q.v.) of Gloucester, England, is the founder of the modern Protestant Sunday school. He first thought of the work in connection with a number of children of wretched appearance whom he saw playing in the suburb of the city where he lived. He was informed by an instructor of a Protestant church that on Sundays, when the children were released from work, and the few who enjoyed the benefit of any instruction during the week were free from school, they presented a more attractive sight of the universe. Education immediately suggested to him the idea that the profession of the day might be prevented by keeping them occupied; and he engaged several women, who kept schools in the neighborhood, to receive such children as he should send to them on Sundays and instruct them in reading and the catechism, paying each of them a shilling for her day's work. He soon collected a considerable number of children, distributed books among them, gave them advice, settled their quarrels. The effects of his benevolent exertions were so beneficial that his example was followed by other charitable persons in different quarters of the city and in a few years Sunday schools were established in almost every part of Great Britain. Raikes made his first experiment in 1781 and in 1786 it was estimated that 250,000 children were receiving instruction in Sunday schools. A Sunday school society was formed in 1785 and the members were encouraged to give their personal service gratuitously. In 1803 the first Sunday school union was formed in London and the example was soon imitated in many large towns and some of the counties. The Scotch Sabbath schools (first established in Edinburgh in 1782) arose from the English Sunday schools, but from the first were more entirely devoted to religious instruction than the Sunday schools of England. The first Sunday schools united secular with religious instruction. Sunday schools were established in Protestant churches in Scotland, Ireland and America, in the years immediately following their establishment in England; the Scotch Society for Promoting Religious Instruction Among the Poor was formed in 1796 and the Irish Sunday School Society was founded in 1809, though a system of Sunday teaching had prevailed in Ireland for some years previously. In later times Sunday schools increased rapidly in connection with all Protestant churches throughout the world. The Sunday school movement was not at first looked upon with favor by the people of New England. It was regarded as a menace to the sacredness of the Sabbath and also as an infringement of the home duties. The Protestant Sunday school, as it exists to-day in the United States, may be said to have had its real beginning in Philadelphia 19 Dec. 1790, when 12 persons held a meeting and decided to begin the work. Sunday schools had been established in the United States shortly after Raikes had begun his work but they existed more as local institutions. On 11 Jan. 1791 a society was established in Philadelphia which had for its object the support of Sunday schools, to whom he addressed himself, president of the society was Bishop William White and Matthew Carey was the secretary. In New York 13 Jan. 1816, a woman's society for the promotion of the work and in the same place, on the 20th of February of the same year, a society of men was organized for the
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same purpose. The American Sunday School Union is the outgrowth of the Sunday and Adult School Union, established in Philadelphia in 1817. The new and broader organization took definite form 24 May 1824. On the 75th anniversary, the American Sunday School Union had 100,928 Sunday schools with a membership of 4,070,346 pupils and 578,680 teachers. It had distributed literature amounting to near $10,000,000. The first national convention was held in Chatham Street Chapel, New York, 3 Oct. 1832. National conventions were held 23 May 1833 and 22 Feb. 1859, in Philadelphia; 29 April 1869, Newark, N. J.; 16 April 1872, Indianapolis, Ind.; 11 May 1875, Baltimore, Md. At the Baltimore meeting the convention took upon itself the name international, to which title it had a right on account of the enlargement of the work both in aim and territory. On 1 July 1889 a world's convention was held in London. Other world's conventions have been held in Saint Louis, Mo., 3 Sept. 1893; London 11 July 1898. The organization embraces, besides the usual executive officers, lesson committees and different department work, all of which are held at annual State conventions, county conventions and city conventions. The department of field workers is most important. In fact their main work is the financing of missionaries in sparsely settled and neglected localities where they found and foster evangelical but undenominational Sunday schools. Morris K. Jesup, who was for many years the president; Gen. O. O. Howard, Jay Cooke, William E. Dodge, Louis Klaiber and other prominent men have taken a great interest in the Union's work. In the decade ending 1917, they organized over 17,000 new Sunday schools, reorganized 7,000, besides aiding several thousand public schools. The Chautauqua (q.v.) has been a great aid in the enlargement of the work. In 1908 the Protestant Sunday schools in the United States, including Hawaii and Porto Rico, numbered 140,739, with a membership of 11,355,000 pupils and officers and teachers numbering 1,305,000. In 1917 the Protestant and miscellaneous Sunday schools had over 19,000,000 scholars enrolled and the Catholic schools 2,850,000 more; the Methodist group was the largest, comprising 4,900,000 pupils and 300,000 members, followed with 3,800,000; Presbyterian, 2,000,000; Lutheran, 1,000,000; Disciples, 940,000; Congregationalist, 750,000; and Episcopal, Reformed and United Brethren, each nearly 500,000.

All the teaching orders in the Roman Catholic Church, in all countries, give religious instruction in the regular schools, and, when necessary, classes are organized and held on Sundays. The Sunday classes are graded and the regular school classes. The founder of the first normal school for the training of teachers, Saint John Baptist de La Salle was most earnest in having his teachers prepare themselves well for the work of teaching Christian doctrine. The members of his order (popular name, Christian Brothers) have charge of many Sunday schools. Both Protestants and Roman Catholics have established training classes and normal schools for Sunday school teachers. In New York, in 1914, under the auspices of the Confraternity of Christian Doctrine, a training school for teachers in the Roman Catholic Sunday school was established, and affiliated with it are local training classes.

Conventions and Conferences.—The Protestant Sunday School conventions, international, national, State and county, are most inspiring and educational. The question brought home to the members, most forcibly, and at all the conventions, is that the Sunday school is a necessary feeder of the Church, that to have the adult a communicant, the child must be instructed. As a direct result of the great conventions there has grown up a vast Sunday school literature, the churches have been arranged so as to provide suitable meeting places for the Sunday schools. The Sunday school terms are also a center of interest of the conventions and conferences. In the Roman Catholic Church every educational convention, congress, or conference, has for its beginning and end, the subject of Christian doctrine. Sunday school conferences have been held at the Eastern and Western Roman Catholic seminaries, and other cities have had, for some years, regular annual Sunday school conventions.

International Lessons.—In 1872 at the national Sunday school convention in Indianapolis, the plan of having a series of uniform Bible lessons was proposed and met with favor. The lessons were adopted by the Sunday schools of Canada and England, and came into use in many of the Protestant English-speaking Sunday schools of the world. Several periodicals and a large number of books are published as aids for the International Sunday school lessons. Another plan of Bible lessons in use in many parts of the United States is the Blakeslee or inductive system. In the Roman Catholic churches the system in general is based upon preparation for the sacraments (q.v.). Bible study is correlated with the catechism lessons. In addition to the general system, in many dioceses there is a prescribed course of study for the Christian doctrine work (New York, Philadelphia, Brooklyn, etc.). The Jews have regular courses of study for their Sunday schools, which in the United States are conducted by the Orthodox.

SUNDERLAND — SUNFISH

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SUNDERLAND, Jabez Thomas, American Unitarian clergyman: b. Yorkshire, England, 11 Feb. 1842. He was graduated from the University of Chicago in 1867 and from the Union Baptist Theological Seminary in 1870. He was editor of 'The Unitarian Monthly' 1887-1907 and has been pastor in Milwaukee, Chicago, Ann Arbor, Oakland, Cal., London, England, Toronto, Ontario, Hartford, Conn., and Poughkeepsie, N. Y. He has been director of the American Unitarian Association, secretary of the Western Unitarian Conference, president of the Michigan Unitarian Conference and non-resident lecturer on the Religions of India in the Meadville (Pa.) Theological School. He is a member of the Michigan Authors Club. Has the following honorary degrees: A.B., A.M. and B.D. from the University of Chicago and D.D. (1914) from Tufts College. He was sent to India, 1895-96, by the British and Foreign Unitarian Association, to study the educational, social and religious conditions of the Indian people, and made an extended report on the same on his return to London. In 1913-14 was Billings Lecturer of the American Unitarian Association in Japan, China, Ceylon and India. Was president of the All-India Theistic Congress, held 1912 by the long or mangle faction and contributed reviews and other periodicals in the United States, Canada, England and India. He is author of 'A Rational Faith' (1879); 'What is the Bible' (1878); 'The Liberal Ministry' (1889); 'Home Travel in Bible Lands' (1894); 'A College Town Pulpit' (1895); 'Liberal Religion in India' (1896); 'A Pacific Coast Pulpit' (1898); 'Travel and Life in Palestine' (1900); 'James Martineau' (1905); 'The Spark of Life in the Cloud' (1906); 'India as a World Religion' (1913); 'Liberal Religion as a World Movement' (1913); 'Military Preparedness the World's Menace' (1916).

SUNDERLAND, England, a seaport town and parliamentary borough of Durham, at the mouth of the Wear, 13 miles northeast of the city of Durham and 12 miles southeast of Newcastel-upon-Tyne. The chief buildings are the magnificent Town Hall, Museum, Art Gallery, Libraries and the old parish church of Saint Peter's, on the site of the monastery in which the venerable Bede was educated. Sir Joseph Swan the electrician ('Ediswan') was born here. Two lighthouses stand on the entrance of the excellent harbor. The industrial works include shipbuilding establishments, marine engine works, bottle, pottery and rope factories, coal mines, iron works, paper mills, anchor and chainworks. Coal is the chief export. The limonite are timber and grain, together with materials for use in manufactures, and provisions. These are brought from Baltic ports and Holland. Pop. about 166,000.

SUNFISH, a fresh-water fish of the family Centrarchidae, closely related to the perches (Percidae) and including also the black bass, crappie, and calico bass. These fishes are among the most characteristic of the fresh waters of the United States, where all of the 12 genera and 30 species are found, and of these only one (Archoplites interruptus) occurs west of the Rocky Mountains. Because of their abundance, beautiful colors and forms, interesting habits, courage and gameness, they are perhaps the best known and most esteemed of fresh-water fishes. Most of the true sunfishes belong to the genus Amphiphractus and E. gibbosus, and the different species are not readily defined without a long technical description; but to the layman, or rather boy, all are known collectively as *sunnies*. The commonest and most generally distributed species is the Allegheny Mountains is E. gibbosus, one of the brilliant beauties of our clear brooks and ponds, the type of piscine courage and pugnacity, not fearing to assault any fish that approaches its nest, and itself proof against attacks even from pickerel. Like other sunfishes, it builds a nest of cleaned pebbles on a warm sunny bottom in shallow water, and the male stands guard over the eggs until they hatch and the young are able to care for themselves. This is the boy's favorite game-fish, and it is an excellent morsel on the table. An equally beautiful and larger species, abundant in more sluggish waters throughout the same range and westward, is the blue sunfish (L. pallidus). The long-eared sunfish (L. auritus) is distinguished by a white spot between the eye and the gill cover. The spotted sunfish (Enneacanthus gloriosus) is a most beautiful little fish with gracefully flowing fins and brilliantly spotted translucent body. A large marine sunfish is the prevailing species (Mola mola) of the plectognath family.
Molidae. It is almost circular in form, and the dorsal and anal fins project posteriorly, with the caudal between. The posterior part of the body looks as if it had been cut square off and then the tail replaced, and something like this actually happens in the development of the young. On each side, near the centre, is a small, penniserrate, and forked, finnion; the gills are arranged in comb-like fringes. It attains a large size, four or five feet, in length and three or four feet in depth, with a weight of several hundred pounds; the flesh is white, tough, and a disagreeable odor, unfit for food, and remarkably elastic, the last property depending on the great amount of yellow elastic fibre, interlaced in an intricate manner, almost to the exclusion of white fibre and muscle. It is grayish above and whitish below, with a silvery lustre when alive, and phosphorescent at night, which, with the rounded form, has given rise to a sailor’s name, moonfish. It is sluggish in its motions, and is often seen asleep at the surface; when swimming, it is said to move round like a wheel, and to be able to float with the head and eyes above the surface; the liver is very fat, and its oil is used for lubricating purposes on board ship, and for sprains and bruises among fishermen. Sailors fasten lines from the elastic subdermal tissue. In some seasons it is common in summer in Massachusetts and New York bays, and feeds partly if not principally on medusae or jellyfishes. There is probably no fish more infected by parasites, internally and externally; the flesh and intestines contain many entozoa, and the skin is studded with crustacean parasites. Consult Gunther, ‘Introduction of Fishes’ (Edinburgh 1880); Bollman, ‘Review of Sunfishes’ (Reprint, United States Fish Commission, Washington 1892); Abbott, ‘Naturalist’s Rambles About Home’ (New York 1887); Dean, Bashford, ‘Fishes, Living and Fossil’ (New York 1895).

**SUNFLOWER**. The common name of the New World plants belonging to the large composite genus Helianthus; so called because the heads are likened to the sun. The robust annual sunflowers (Helianthus annuus), native to the prairies of the American West, where they grow over large tracts, sometimes so tall that they hide a horseman riding among them, are often planted as a coarse but brilliant ornamental plant good for concealing fences and the like. The leaves are numerous, rough, very large, and somewhat heart-shaped; the flowers sometimes measure a foot in diameter, generally nodding, and inclining to the sun. The disc is very broad and brownish, and its tubular florets develop four-sided very oily achenes, which are a tid-bit for the Tatars, have been used somewhat for food by the American aborigines, and are the main resource of some seed-eating animals and birds. In Russia, and in some modern gardens, sunflowers are grown solely for these fruits, which form a valuable food for poultry, and yield an oil, useful for either illuminating or soap-making. They are said also to be a remedy for beginnings of boracic spots. H. angulosus has narrow graceful leaves, and brown, disked flowers, and is quite apt to bloom from top to bottom, a distance of some 10 feet. H. dissectifolius var. multiflora is one of the best for cultivation, being not so coarse as other species, and having long-stemmed, clear-yellow flowers, sometimes double, and about three inches across. H. mollis is also interesting, for its soft, white velvety foliage, and stands only about five feet high. H. subtilerous, the Indian potato, has thick lanceolate leaves, and fleshy roots, which are thick, and edible. It is found on the Northwestern prairies. H. tuberosus, with a wider range, has ovate leaves, and fleshy thickened rootstalks bearing the tubers called Jerusalem artichokes. It often grows along roadsides in the East, having been cultivated, doubtless, by the aborigines, and is now largely grown as a fodder for livestock, especially valuable in dry seasons, and as a vegetable for fall.

**SUNFLOWER STATE**, a popular nickname for the State of Kansas, so named from its prolific growth of sunflowers.

**SUNGA.** See INDIAN HUMPED CATTLE.

**SUNGARIA, soon-gâr-é-â, or DZUNGARIA, a region of central Asia, once an independent kingdom. It is not well delimited but comprises generally the district of East Turkestan north of the Tarim Basin and between the Altai and the Tian-Shan mountains, west of Mongolia. In the 17th century the Sungarians extended their power over a region much greater than that above indicated. In 1670 the Chinese overran the country but were driven out after 40 years, when the Sungarians re-established their independence. The new kingdom did not last long, however, for in 1759 the Chinese conquered and annexed it to their empire. Chinese colonists were thereafter sent there in great numbers.

**SUNIUM, su-nil-fim, or CAPE COLONNA, Greece, a promontory forming the southernmost point of Attica, 28 miles southeast of Athens. It consists of a mountain or hill which in ancient times was fortified and crowned by a marble temple of Athena. Portions of the walls and 13 of the columns of the temple still remain. At the foot of the mountain lay the silver-mining town of Sunium.

**SUNKEN BELL, The.** Gerhart Hauptmann’s ‘Versunkene Glocke’ (‘The Sunken Bell’) (1896) is commonly supposed to be the poet’s elegy on the failure of the hopes which he had set upon the attempt to adapt naturalistic methods to the treatment of an historical subject in ‘Florian Geyer’ (first played 4 Jan. 1896). Quite as probably, however, Hauptmann symbolized in this fairy drama a mood to which poets as such are no strangers, even without the chagrin of recent defeat; the melancholy sense that ascent to spiritual heights is toilsome and is impeded by fetters to the lower earth. Moreover, there are spirits of the depths as well as of the heights.

The bell-founder’s wife, driven by his supreme ambition, to place a bell in a mountain chapel, by the malice of a wood-sprite who cannot abide the ringing of it, and despairing he plunges into the abyss which engulfs the chime, becomes the product of his WesternHeart, an unesthetic wife can give him neither comfort nor the courage to live. Both come to him from a mountain elf, Rautendelein. In association with her, he plans a new masterpiece,
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half church, half temple to the sun, but he is not destined to accomplish his design. The humdrum dwellers in the valley persecute him as a renegade; the wood-sprites assail him in hostility like Loki's to Balder; the tolling of his submersed bell recalls him to where he with childlike expectation failed of his goal. He repulses Rautendelein and hastens below—but only to return and discover, a moment before he breathes his last, that his proper dwelling place is with her on the heights, and that the nether sphere, the realm of slavery and of death, is that from which no man can escape.

The play, rich in elements derived from German folklore, with some reminiscences of classical mythology, is enhanced by the contrast of naturalism and fantasy, and contains, along with some hollowness, the most intense and musical poetry that its gifted author has ever written. Translated by Mary Harned in 'Poet Lore' (Vol. X., 1898), by C. H. Meltzer (Garden City, 1915), and by Ludwig Lewisohn (in 'The Dramatic Works of Gerhart Hauptmann', New York 1913-15). Edited by T. S. Baker (New York 1901). Cf. Ludwig Lewisohn, 'The Modern Drama' (New York 1915).

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SUNN HEMP. See Fibre.

SUNNAH, sün'a, SONNA, or SOON-NUT, the oral teachings of Mohammed, built upon his sayings and practices, and other traditions regarded as authoritative by the orthodox Mohammedans, although not part of the law, as set forth in the Koran. A great number of so-called "Traditions" were fabricated to uphold certain political and sectarian claims, but these were subsequently rejected. The six standard Sunni collections were all compiled under the Abbaside caliphs, and the earliest of them partly during the reign of Al Mamun. The four canonical collections of the Shiias are of later date and less trustworthy. See also MOHAMMEDANISM; SUNNITES.

SUNNITES, sün'ités, or SUNNI, the orthodox Mohammedans, who accept as authoritative the oral teachings of Mohammed, the deliveries of the orthodox imams, and the various traditions assumed to be traceable to those who had the confidence of the prophet, in addition to the Koran, which is received as law by Mohammedans of every sect. The Sunnites regard as heretics the Shiites (Shia) who do not accept the Sunni, as the body of oral tradition is regarded. While the animosity between the two great divisions of Islam, like that between Christians of different creeds, has vented itself, and among the more prejudiced still finds expression, in bloodshed and bitter persecution, there is a much more tolerant feeling in the present age than existed in the past, and Shiites occupy important places in the Turkish empire, which is almost universally Sunni. The Sunni contend that Mohammed never intended to establish any hereditary right in his descendants. See MOHAMMEDAN.

SUNNYSIDE. Washington Irving's estate at Irvington, N. Y. It is close to the Hudson River, about half a mile north of the Irvington railway station. It was bought in 1835 by Irving, who gave it the name of Sunnyside; at that time the estate contained 10 acres, later eight more acres were added. A small stone house was standing on the estate, known as Wolffert's Roost, which during the Revolutionary War was a station of the Dutch "water guards" who watched and constantly annoyed the British ships anchored in the river. It was an old-fashioned mansion, with many gables and according to Irving "as full of angles and corners as an old cocked hat." Its picturesque ness pleased the author's fancy, and while he had it enlarged and modernized under the direction of an artist, George Harvey, he was careful to keep its "old-time" appearance. English ivy grown from a slip brought from Melrose Abbey, was trained over the front, which it now completely covers. Though additions have been made to the house since Irving's time, the old part has not been materially changed, and maintains the same general appearance.

SUNSHINE STATE. The name given by statute to South Dakota, which is also known as the "Koyote State."

SUNSTONE, or aventurine feldspar, a variety of feldspar showing a beautiful golden schiller. This is due to the reflection of light from the surfaces of minute, tubular crystals of hematite or goethite, enclosed in the spar in parallel position. Under the microscope, or even with a pocket lens, these little crystals appear gorgeously iridescent. Sunstone from Tvedestrand, Norway, the finest known, is a reddish variety of olivine. A green microcline sunstone occurs in Pennsylvania.

SUNSTROKE, prostration due to exposure to intense external heat. Such exposure may be to the direct or indirect rays of a tropical sun or to the excessive heat of an engine room. In either case heat and physical exertion combine to bring about the results. A high degree of humidity of the atmosphere is one of the most important features, since this hinders free evaporation of fluid from the body which is one of the most important devices for cooling the body. Sunstroke was defined by Osler mentions that two instances are on record in the Bible and many of the ancients described it very well, confounding the severer forms with apoplexy. Two main types are seen—heat exhaustion and heat stroke. Other terms for heat stroke are isolation, thermic fever, coup de soleil.

Heat exhaustion is frequently seen among workmen who are exposed to the direct action of the sun. Bricklayers, drivers, farmers, etc., or firemen and stokers in large vessels, while in the midst of their work suffer from extreme prostration. There is great restlessness, muscular weakness, fainting spells and collapse, and often delirium. The surface of the body is usually cool and the temperature may be subnormal, 95° to 96° F., the pulse is small and rapid and unconsciousness rapidly develops. In heat stroke or thermic fever, the symptoms are quite different. Here marked physical exertion and direct exposure to the sun with high humidity are important factors—in addition some form of alcoholic drink is being taken, notably ale, beer or whisky. In the severe grades the patient may be suddenly struck down and die with rapid breathing, heart weakness and uncon-
SUPEREROGATION—SUPERIMPOSED DRAINAGE

Supererogation, performance of more than duty requires, for example, if one commits theft of a dollar and makes reparation of the wrong by giving back two dollars; or if one not only forgives those who injure him, but confers unmerited benefits upon them. The Anglican Church, in the 14th of the 39 Articles of Religion, expressly condemns the notion of works of supererogation as impious: “Voluntary works besides, over and above, God's Commandments, which they call Works of Supererogation, cannot be sought without arrogancy and impiety; for by them men do declare that they not only render unto God as much as they are bound to do, but that they do more for his sake than of bounden duty is required; whereas Christ saith plainly, When ye have done all that is commanded you, say, We are unprofitable servants.” Supererogation is not a term of theology in the Roman Catholic Church; but that Church teaches that good works done by the faithful in the state of grace are meritorious of eternal reward, and that merits of holy men redound, through the goodness of God, to the spiritual advantage of the whole Church. This doctrine differs not from that taught in the "Institution of a Christian Man," published by authority of convocation in 1537.

"I believe that whatsoever spiritual gift or treasure is given by God unto any one part or member of the mystical body of Christ, although the same be given particularly unto this member, and not unto another, yet shall they who are therein shall, by reason of that incomprehensible union and bond of charity which is between them, redound immediately unto the profit, edifying, and increase in Christ's Body of all other members particularly.

SUPERFÉTATION, a second conception and the formation of a fetus after a previous impregnation in the same female, whereby two fetuses coexist in the uterus. In such a case a woman may be delivered of a full-grown child and of an undeveloped embryo at the same time, the period of conception of each being presumed to be different; or a woman may be delivered of two living children, the one appearing much more developed than the other. In recorded cases women have given birth to twins, the one child being white and the other black, showing that each had a separate father and of a distinct race, and proving the possibility of a double conception. But far more typical cases of superfetation have been found. Such is that instance in which a woman, published by Eisenman of Strassburg, a woman was delivered of a second child 140 days after the first, both children being fully developed. In this case, therefore, the second child must have been conceived at a later and different period from the first; and the development of the second child must have been proceeding separately from that of the first, and after the latter was born. Still more remarkable cases of this kind have been recorded. The explanation of these curious cases has afforded a very intricate study and puzzle to obstetricians and physicians, as well as to those concerned with their medico-legal aspect, which sometimes bears directly upon questions of conjugal fidelity. As the subject is an important one, full elucidation is still a matter for obstetrical investigation; but there can be little doubt either of the actual occurrence of cases of superfetation, or of the great importance of the study of its phenomena.

SUPERHEATERS. See Locomotive.

SUPERIMPOSED DRAINAGE. When a stream flowing across a region cuts down and uncovers an old buried erosion surface the
drainage is said to be superimposed on that surface. For example, if any familiar region of hills and valleys should sink beneath the sea, and all the old surface be buried beneath sands and muds, a plain would result. If this plain would then emerge an extreme were off at start flowing over it, the new streams would pay no attention to the old buried topography, but would wander freely over the plain. As they cut down the region, they would uncover this old topography, and superimpose upon it. Such is much of the drainage in the glaciated regions, where glaciation has filled up the old valleys, and obliterated the old preglacial drainage.

SUPERIOR, Wis., city, port of entry, county-seat of Douglas County, on Lake Superior, and on the Northern Pacific, the Chicago, Saint Paul, Minneapolis and Omaha, the Duluth, South Shore and Atlantic, the Great Northern, the Minneapolis, Saint Paul, and Sault Sainte Marie, the Chicago, Milwaukee and Saint Paul and the Chicago and Northwestern railways, opposite Duluth. It shares with Duluth the commercial advantage of being the extreme western port of the Great Lake system of the United States. It has three connecting harbors, well sheltered and deep, making a combined length of 16 miles, and an extreme width of three miles. The city comprises the ports known as East, West, South and Old Superior. The climate is cool in summer and cold in winter. The chief manufacturing establishments are flour and lumber mills, iron and steel works, boiler works, windmill, factories, shipyards, bag factories, tractor factories, cooperage, chair factory, wagon and carriage works. Lath, shingles and other lumber products are also manufactured. It has also shipyards, coal docks capable of receiving 6,370,000 tons of coal, large grain elevators, a large dry-dock and a number of wholesale merchandise establishments. The government census gives the amount of capital invested in industries $70,000,000, and the annual value of the products $111,663,000. There is an extensive lake trade, and railroads furnish transportation for products sent to the interior. The principal public buildings are the government building, county court house, market building, Saint Francis Hospital, Saint Mary's Hospital, Woman's Christian Temperance Union Hospital, national and State banks, several business blocks and hotels. The educational institutions are a State normal school, the Finnish University, two business colleges, two high schools, public and parochial schools and two public libraries. The commission form of government is in operation. The port's foreign trade has become extensive in recent years, having now an annual volume of about $1,500,000, of which 80 per cent is in exports. The city's annual expenditure on various municipal activities is about $550,000, of which $200,000 is expended on schools, $100,000 on fire protection and $60,000 for police. Pop., about 62,500.

SUPERIOR, Lake, the largest expanse of fresh water in the world and the most westerly and most elevated of the great lakes of the Saint Lawrence basin; lat. 46° 30' to 49° N.; long. 84° 30' to 92° 20' W. It washes the shores of the State of Minnesota on the west, of Wisconsin and the northern peninsula of Michigan on the south and of Canada on the north and east. The greatest length, measured on a curve through its centre from east to west, is 420 miles; greatest breadth, 167 miles; circuit, about 1,750 miles; estimated area, 31,200 square miles; length above the feet 602 feet; approximate mean depth, 900 feet; maximum depth, 1,008 feet. It is of very irregular shape, widening out toward its centre and gradually narrowing, partly toward its eastern but much more toward its western end, to form an irregular crescent, with its convexity on the north and its concavity on the south. The northern shore is generally bold and elevated, presenting almost continuous ranges of cliffs, which vary in height from 300 to 1,500 feet; the southern shore is low and sandy, though occasionally interrupted by limestone ridges, the most remarkable of which, situated toward the eastern extremity, present a perpendicular wall 300 feet high, broken by numerous caverns and projections, and forming, under the name of the Pictured Rocks (q.v.), one of the greatest natural curiosities of the United States. The central portion of the lake is clear of islands, but there are smaller ones toward both the southern and the northern shores. In the former direction they are small, and, being insufficient to give shelter behind them, only increase the difficulties of navigation without contributing to form a single good harbor. On the north shore several of them, more especially the Isle Royale, are of considerable dimensions, and along with the indentations of the coast afford good shelter for vessels. The water of the lake, remarkable for its transparency, derives its supplies from a basin which is estimated at 54,000 square miles, and is drained by more than 200 streams. The water never freezes except in the shallow regions along shore. About 30 of the islands are of considerable size, but they are almost all impetuous torrents, interrupted by rocks and rapids. Superior discharges into Lake Huron, at the southeast end, by Saint Mary's River, which at Sault Sainte Marie descends 22 feet in three quarters of a mile, navigation being here carried on by means of two ship canals, one on the Canadian, the other on the United States side. Within the lake itself the only obstruction to its navigation are the violent gales to which it is subject. It is supplied with fish, principally trout, whitefish and sturgeon. There are a great number of fishing-stations. Large deposits of copper and iron are worked on the shores of the lake, especially on the southern shore along the northern coast of Michigan. The boundary line between Canada and the United States, in passing through Lake Superior, proceeds from the outlet nearly through its centre till it approaches Isle Royale, when it bends north so as to give that island entirely to the United States. It is carried south-southwest to its termination at the mouth of the Pigeon, in lat. 48° N. The chief towns on the shores of Lake Superior are Duluth, Minn., at the western extremity, with an excellent harbor; Houghton, Keweenaw Peninsula; Marquette, Mich.; Fort William, Ontario, also with a good harbor; and Port Arthur, Ontario. Consult Agassiz, 'Lake Superior: Its Physical Character, Vegetation and Animals' (Boston 1850) and Martin, 'Progressive Development of Resources in the Lake
SUPERNATURALISM — SUPERSTITION


SUPERNATURALISM, "above nature" or miraculous, in theology, the generally received belief that divine revelation is the sole and ultimate ground of the Christian religion; it is opposed to naturalism, the theory that what contain many truths these truths are only a reassertion of natural religion and therefore unnecessary; it is also opposed to rationalism (q.v.), which makes reason the supreme arbiter in all matters connected with revelation and the religion of Christ. Supernaturalism regards the Christian religion as an extraordinary phenomenon out of the circle of natural events and as communicating truths above the comprehension of human reason. Though the supernaturalist, no less than the rationalist, employs reason in matters of revelation, he does so only to search and judge those claims to a divine origin which Christianity puts forth; when he is once convinced that Christianity contains the correct teachings of God, it becomes his highest, his sole authority; called also supernaturalism.

SUPERPHOSPHATE FERTILIZERS. See FERTILIZERS.

SUPERSTITION, Popular. That which others believe and we do not, is classed as superstition. The religion of our friend, if differing radically from our own, seems to us a superstition. In the heart of nearly every human being, savage or civilized, exists a settled conviction that he dwells in the midst of an unseen world, peopled with beings of strange powers, who thwart the plans of his own life or assist him in his endeavors. Folklore, legends, ghost stories and witch tales were early in the 19th century regarded as mere fables, but in the light of modern science they are now as worthy of study as the surely not less indec31e recitals of Roman and Greek mythology. Every profession, trade and occupation has its peculiar superstitions lore. Even the farmer who studies the actions of animals will tell you what they portend concerning the weather and in many cases sensibly, too, for they build their homes and lay in their food through instinct given by Divine Providence with reference to the coming winter; they house themselves before the coming storm; their coats are heavy or light, as the winter shall be severe or otherwise, and they often give the farmer who watches them valuable indications concerning his crops. So to a greater or less extent man has followed the habit of the bird and the beast; he has been guided in all his acts by omens; he has often planted his crops, gathered his harvests, made his journeys, waged war, built his house and gone fishing and hunting according to imaginary signs and superstitious beliefs. Though many of the old omens and superstitions have passed into oblivion, there still exist among two or three race of people hundreds and thousands of popular beliefs and many of them seem destined to be extant as long as man exists. As indicative of the variety, peculiarity and unusual extent of present-day superstition, the following examples were collected from among the inhabitants and peoples of the world and now first collected will prove of undoubted interest alike to scientist, student and casual reader.

SUPERSTITIONS OF THE WORLD.

Africa.—The snake is held in superstitious reverence by some African natives, who once a year kill a cobra de capello and hang its skin to the branch of a tree, tail downward. Then all the children born during the last year are brought out and made to touch the skin. This, their parents think, puts them under the serpent's protection. The Kaffirs use the venom of the puff adder, to poison their arrows, and when they have any small quantity left they swallow it, having a theory that it will protect them from the effects of future bites. If they find a dead serpent they dress it in clothes and give it a superb funeral.

American Indian.—Various tribes of American Indians have a theory that every white deer has a "mad stone" in his stomach. They believe that the "Great Spirit" places this stone in the white deer's stomach, which is a "magnet" that a delicate animal may take in while eating grass. Feathers figure very prominently in the religious customs of most aborigines, and remarkably so in the Southwest. Among Navajos and Pueblos alike these plumage symbols are of the utmost efficacy for good or bad. They are part of almost every ceremonial of the infinite superstitions of these tribes. Any white or bright-hued plume is of good omen — good medicine, as the Indian would put it. The gay feathers of the parrot are particularly valuable. The Navajo Indian will not eat fish under any circumstances, and cherishes the belief that the use of such food will be followed by dreadful punishment.

Arabia.—Many Arabs, when overtaken by severe storms in the desert, cry out, "Iron! Iron!" which they think will propitiate the evil spirits who have raised the storm.

Arctic Regions.—The Eskimos believe in ghosts. Many also believe in the transmigration of the souls, that spirits return in animals, winds, rocks, ice and water, that they are evil, angry or good, as the elements may be favorable or unfavorable, and that they can be appeased by hoodoo rites if the performer is sufficiently versed in occult science. To chase away the wind they chant, drum and howl against it, build fires, shoot against it, and, as a last resort, fire the graves of the dead. Eclipses of the moon create the greatest consternation and almost paralyze the people with fear. When a child dies in some parts of Greenland, the natives bury a live dog with it, the dog to be used by the child as a guide to the other world. When questioned in regard to this peculiar superstition, they will only answer, "A dog can find his way anywhere."

Australia.—Some Australians say that Mit- yau, the moon, was a native cat, who fell in love with some one else's wife, and was driven away, to wander ever since. The natives of New Zealand tie the hands of their dead together and pull out their nails; this is for fear that the corpse may scratch its way out of the grave and become a vampire.

Bohemia.—The peasants of Bohemia have a queer superstition by which they think to rid themselves of the depredations of sparrows among their crops. A frequent charm is to
SUPERSTITION

plant, in the centre of the field, a stick or splinter of wood taken from the timber of which a coffin has been made, or to scatter about pieces of the coffin itself. It is also considered very effective to lay upon the threshold or window-sill of the barn or storehouse a human bone taken from a grave. In Bohemia the willow is said to be the tree on which Judas hanged himself, and it is supposed to have a special attraction for suicides.

Brazil.—Religious superstitions are common here. Once a year some churchmen dress up a figure to represent Judas (usually with red hair and sandy beard), and give it to the street arabs, who carry it about until it has been ridiculed by stones and other missiles and then burn it on the commons. In the same country the sailors dress a figure on certain feast days, subject it to all sorts of indignities, winding up the ceremony by hanging it at the yard-arm.

China.—Many Chinese guard their homes from witchcraft by suspending spectacles of herons' and cranes' legs on the door. At the new year the Cantonese clean out their houses and post near the doors a pair of scrolls made of red paper (the lucky color) bearing an inscription such as "Leaves of the moxa, like a banner, procure a hundred blessings." In China superstition is regarded with superstitious reverence and pride. In China, too, the old man of the moon is known as Yue-loa, and holds in his hands the reins of marriages among mortals. The future husband and wife are tied together by an invisible silken cord, which is only severed at death.

Cuba.—A belief very prevalent among the common people is that the rain water of May has peculiar beneficial qualities which that of no other time possesses. The moonlight in Cuba seems particularly objectionable, and strangers are warned not to go out in it with uncovered head, and not to go out in it at all if it can be avoided; it is thought that this light brings many evil effects and not under any circumstances will a superstitious Cuban sleep in its rays—he thinks that, among other things, it will draw his mouth to one side of his face. The hooting of an owl is taken as a very bad sign. The same as in urban life, they avoid trees of the kind which makes weird sounds near his home. This is supposed to break the spell, and it is not then inevitable that a member of the family shall meet death in the near future.

Egypt.—When Egypt was in the height of her power her people worshipped a black bull with a circular white spot in the exact centre of his forehead, and the advent of such a creature in any herd was the signal of wild demonstrations. Even as late as the time of Cleopatra such animals were shod with gold, and had their horns tipped with the same metal. Herodotus tells of a man who died with grief because he sold a cow that soon after became the mother of a black bull calf marked with the sacred white circle in his forehead. In modern times the Egyptian housewives mark their bread loaves with a cross, and housemaids insure a brisk kindling of a newly lit fire by making the same sacred sign over the grate. The sacred ibis of the Egyptians was supposed, from the color of its feathers to femalitve the light shade of the moon. It is said that its feathers would scare, and even kill, the crocodile. The bird was believed to deliver Egypt from winged and other serpents that came from Arabia. It was so deeply venerated that it entered the most sacred temples with impunity, and to kill one, even by accident, was a crime punishable with death. After death, its body was embalmed, and thousands of their remains have been found at Thebes, at Memphis and at other Egyptian cities.

England.—In England there existed, even so late as the 18th century, a superstitious belief that a man condemned to be hanged could escape that undesirable fate provided some compassionate woman came forward at the foot of the gallows and expressed her willingness to marry him. Superstition has always clung to the cricket. In Hull it is unlucky to kill them, and in Lancashire, it is said, they cut holes in the worsted stockings of those members of a family that kill them. It is a custom in many parts of England and the Continent to announce to the bees a death in the family, especially that of the master. Another superstition is that if the bees settle on the dead branch of a live tree a death will occur in the family within a year. In some places it is thought unlucky to sell them. They are given away for another gift. It was a popular superstition in Norfolk, that whatever you are doing the first time you hear the cuckoo, that you will do most frequently all the year. The English housewife will not sweep the dirt out of the front door, fearing to sweep away the fortune of the house. In the north of England, the peasantry do not favor naming a child after some respected ancestor; that departed worthy might not like it. In the same locality when the dairy maid churned for a long time without making butter, she would stir the cream with a twig of mountain ash and beat the cow with another, thus breaking the witch's spell. But to prevent accidents of this nature it has long been customary to make the churn staff of ash. For the same reason herd boys employ an ash twig for driving cattle. In England it was thought, and not many years ago, that oak trees were mysteriously protected, and many superstitions clung round the sacred tree. The hawk used to be hung up at the door of the house of May to guard the dwelling from witches. In Devonshire it was considered unlucky to plant a bed of lilies of the valley, as the person who did so would surely die in the course of the next 12 months.

Fiji Islands.—In the mountain country of the Fijis there is prevalent a superstition called by the natives "Tuka." The priests profess to possess an elixir of life, which, preventing decay or disease, insures to faithful disciples of this faith everlasting youth and vigor and a robust enjoyment of life. The natives who give their adherence to these priests (and this means the giving up of all they possess to them) are promised the life of immortal youth, the immediate resurrection of their ancestors, vengeance on all their enemies and oppressors, whose wives and property they should inherit, together with all the wealth of the white settlers, these latter being also promised to them for domestic slaves.

France.—Perhaps the most common of all French spread superstitions is the belief met with through all the south of France, that the
position of a drowned body may be discovered by a floating loaf of bread. Possibly the only scientific basis is that the loaf is apt to be carried by a current of water just as a body is. The French peasant's faith in fermented grape juice is truly beautiful. If his children are stricken with the measles he gives them beakers of wine, well sweetened with honey and highly spiced with pepper. For a severe cold he administers a quart of red wine and a melted tallow candle mixed. For scarlet or brain fever he gives eggs, white wine and soot, well beaten together. Not all their superstitions are curious—some are pathetic. A mother, for instance, often buries her dead child with its favorite toy, or her own beautiful hair in the coffin, that it may not feel quite alone. Along the sea coast, unless the waters are strewed with flowers by the fishermen's wives and daughters, there will be no fish to catch. A curious superstition which is current among the street gamins of Paris and the large cities of France, is that which makes it unlucky to pass a priest. To break the ill luck, the passer must immediately touch a piece of iron. Gamins carry in their pockets pieces of iron to touch, but none of them seem to know the wherefore.

Germany.—Throughout northern Germany and in the Low Countries the stork is held in beloved reverence, for the peasants believe that where the stork has its brood no fire can ever come. There is a German belief that any one who during his lifetime may have made cats his enemies, is certain to be accompanied to the grave amidst a storm of wind and rain. It is said to indicate good luck to have a spider spring his web downward toward you, but bad luck when he rises toward you. If one has a four-leaved clover, and carries it about on Christmas eve it is believed the owner has the power to see witches. In Germany the apple has been deemed potent against war. In Pomerania it is eaten on Easter morning as a preserver of peace. There is a Christmas night on Christmas night says a German proverb, "the wine ferments heavily in the barrels a good wine year is to follow."

Greece.—Before a Greek selects the day for his wedding he observes most minutely every omen, and with prayer and fasting and sacrifice, takes every precaution. The Grecian mother, before putting her child in its cradle, turns three times around before the fire while singing her favorite song, to ward off evil spirit.

Hawaii.—In the Hawaiian Islands the superstition that the Kanaka holds dearest is that concerning the power of the Kahuna, or native witch doctor. This power is almost limitless. If a native in any way offends a Kahuna he is in deadly fear that he will be condemned to die, and he immediately hunts up a Kahuna higher in rank than the one whom he has offended and asks to have the curse offset and neutralized.

Iceland.—The Icelanders have a superstition which they call "Skipimal," or the speaking of the sea. It is said that utterances can be heard forth from the motionless hulls of vessels; but few can understand the strange language.

India.—The natives of India have many curious beliefs and superstitions, some of which are essentially Oriental in their nature. The Hindus think it brings a person ill luck to be openly admired or praised, and if you should praise or even look too admiringly at a child the mother will hastily withdraw it from notice, and either beat it or say something disparaging of it in order to counteract your ill-omened admiration and avert the jealousies of the gods. In Burma it is rather a suspicious thing to give money for a charitable object. It is supposed to mean that the donor has been very wicked and is desirous to make amends. The Hindu troubled with a wart looks at the new moon, picks up a pinch of dust from beneath his left foot, rubs the wart with it—and when the moon goes so does the wart. In India one may observe the quasi sign of the cross which a Hindu makes should he chance to sneeze while performing his morning ablutions in the Ganges. Having touched his forehead, nose, ears, and cheeks with the tip of his finger, he recommences his prayers from the very beginning, and will do so as often as they are interrupted.

Ireland.—The Irish peasant is subject at all seasons to the sense of unexplained agencies. But at no other time is his helplessness against such fateful and inexorable agencies brought home to him as in Lent. Moreover at this time the auguries and omens assume an especially depressing complexion. Thus the "keen" of the Banshee, always an eerie presager of death, when it occurs during Lent has the gloomy significance of a double funeral. Peasant mothers in Ireland still carry their children to holy wells where the little ones are made to creep on hands and knees beating their infant breasts the while they pray and plead for Lenten mercy on their own and the manifold sins and wickedness of their fellows, and are bathed in the blessed water which is credited with a miraculous power of averting sickness and washing away sin. The ceremony is completed by tying to a tree in the neighborhood of these consecrated springs, a mass of colored rag as a thank-offering and propitiation to the particular patron saint who is believed to preside over the birth of the child and to hold its future in his keeping. The people in the south of Ireland are particularly fearful of the robin entering their homes, for they say that it is always a certain prognostic of severe snows and frosts.

I tale of Man.—One of the superstitious customs in Manxland is for the family on stormy nights to retire to rest at a very early hour, so that the good fairies may unobserved enter to find shelter and repose.

Italy.—In Italy the snake is invulnerable except during the full vintage of the moon, when the serpents are believed to become drunken on the vineyards, and may be slain. The slaying of one of these serpents, though, would be the calling down on the head of the slayer and his family forever some terrible plague. The superstition about snakes as guardians of buried treasure seems to be a favorite one with the Italian peasantry; for they believe that all snakes hover over where such treasures are. In Sicily the time honored superstition of the "Evil Eye" is still so widely spread throughout the island, even among the
upper causes, that no one who does not wear a charm is considered safe. A Venetian superstition is that the young girl across whose feet dirt is swept will never get married. The periwinkle has in Italy gained for itself the name of Death's flower, from the ancient custom of raising it for garlands when an infant died.

Japan.—Japanese sailors think it is a good omen to cross the bows of a foreign vessel and frequently they run considerable danger in order to do it. The Japanese have some curious ideas about their finger nails. One of them is to the effect that they must not be cut before starting on a journey, lest disgrace befall the person before he reaches his destination. Neither should they be cut at night, lest cat's claws should grow out. To throw nail parings into the fire is to invite some great calamity. If, while trimming the nails, a piece should fall into the fire, the person will soon die. They are superstitious about many flowers and that have none of them. Many favorites, as the orchid, gentian, daphne and azalia are utterly prohibited for felicitous occasions. There is also with them an aristocracy of flowers most sharply defined. The iris is of princely dignity, but because of its purple color it is not used for weddings. Some flowers in themselves are regarded as being ill omen. Such is the camellia, for instance, which is neglected because its red blossoms fall off whole in a manner which reminds them of decapitated heads.

Java.—When search is made for the body of a drowned person a live sheep is thrown into the water and is supposed to indicate the position of the body by sinking near it.

Mexico.—In Mexico the Indian carnation bears the name of the flower of the dead, and when a virgin dies it is customary for a young woman to carry a garland of flowers and sweet herbs in front of the coffin. The high priest of the ancient Mexicans gave aloë leaves, traced over with sacred characters, to people going among volcanoes, to protect them from the incident dangers.

Norway.—Norwegian sailors believe in the existence of a sea animal represented as having a fish body with the head of a man and the flowing rings of a boat. The merman sits upon the waves, plays the harp and, following the example of many of the Norse fishermen, wears a red cap. It is never seen more than once in seven years, and no matter how many vessels appear in its sight they all must inevitably perish. A curious custom is practised in Norway, where those in search of a drowned body row to and fro with a cock in their boat, expecting that the bird will crow when the boat reaches the spot where the corpse lies.

Persia.—In Persia the crowing of a cock is the sign of some event affecting the family, and the master of the house hastens to feel the bird's feet. If they are cold it is a premonition of death; but if they are warm the sign is propitious, and the master rejoices in coming good fortune.

Peru.—To procure rain the Peruvians used to lay a live fish in a vessel, half-drown it and give it nothing to eat till rain fell.

Philippine Islands.—In the interior moun-
tain districts the natives have gods innumerable; gods of the air, of the water, and in fact of everything imaginable. When sickness or death approaches, the witch or sorceress of the village is called in. An ox and a pig are killed; she places the reeking skull of the ox over her own head and works herself into a frenzy of invocation. The spirits of the dead receive special honors and sacrifices are made in their behalf. Many curious demons and hobgoblins abound in Philippine superstition, too numerous to be described in detail.

Poland.—Poland has a wealth of animal superstitions. The goat is there considered the best harbinger of luck, while the wolf, crow and pigeon are looked upon as unlucky. The skin of a cat worn on the chest is alleged to cure consumption.

Roumania.—The people of the gypsy tribe believe that a coin or shell or pebble carried by a person becomes imbued with his or her personality. For this reason the gypsies will not part with such an item. On the other hand, a dollar is sought after by Roumanian people throughout the world. In all lands this piece of money is held in high esteem for magical purposes. The gypsies believe that witches use egg shells to make plates, pots and dishes to feed from at their banquets.

Rumania.—Rumanian mothers tie red ribbons around the ankles of their children to preserve them from being harmed.

Russia.—Superstition has always found a place in Russia. The Russian General Skobelev would never ride in battle any other horse than a gray one, since it was on a gray horse that he fought his first battle (in the Russian war, 1863) and he believed that it would be fatal to him to change afterward. The primitive Russians place a certificate of character in a dead person's hands, which is to be given to Saint Peter at the gates of heaven.

Samoa.—The natives of Samoa, in order to secure the admission of a departed spirit to the joys of their paradise, wreath the head of the corpse with flowers, and offer, as the Chinese do, a baked pig to their god in the name of the departed.

Scotland.—In Scotland it is considered unlucky for the mother and her baby to go out of doors until the child is baptized; to be engaged with a ring containing either opals or emeralds; for lovers to give either a Bible as a present before marriage; to be married in a month where there is a letter a, such as May; also unlucky for any of the wedding guests to be dressed in green or black; a crepe bonnet or a band on a gentleman's hat. These ill omens entail lifelong misery to the newly married couple. A young woman who tries on a widow's cap that are son the Marrow is after marriage. It is unlucky to try on your bridal dress before the bridal day; to see your future husband on the day of the marriage until the ceremony. To bring flowering hawthorn into a house denotes a death in the family. In Scotland all salt cellars should be full on New Year's Day; otherwise the household having the empty cellars will suffer want during the ensuing year. In Scotland to pass a barefooted woman before going on board ship will result in scaring the fish. It is unlucky to hear the names Rosie, Fullie and White must never be on a fishing boat at the same time for
the combination will "hoodoo" the catch. Scotch sailors will not speak of a four-footed animal while on the ocean.

**Solomon Islands.**—The savages of these islands believe that the world is a coconuut shell of enormous dimensions, at the top of which is a single man, who communicates with the upper air, where human beings dwell. At the very bottom of this imaginary shell is a stem gradually tapering to a point which represents the beginning of all things. This point is a spirit or demon without human form, whose name is "Root of All Existence." By him the entire fabric of creation is sustained. In the interior of the coconuut shell, at its very bottom, lives a female demon. So narrow is the space into which she is crowded that she is obliged to sit forever with knee and chin touching. Her name is "The Very Beginning," and from her are sprung numerous spirits. They inhabit five different floors, into which the great coconuut shell is divided. From certain of these spirits mankind is descended. The islanders consider themselves as the only real men and women, were formerly accustomed to regard strangers as evil spirits in the guise of humanity, whom they killed when they could, offering them as sacrifices.

**Spain.**—The Spaniards never put the left foot first when stepping on board a vessel, for to do this will surely bring disaster. Spaniards, in the 16th century, believed that spiders indicated gold where they were found in abundance. In Spain the new born infant's face is swept with a pine bough to bring good luck.

**Sweden.**—In Sweden it is unlucky to kill a stork, a robin or a swallow. If one kills a wren he will break a bone before the year is out. It is also unlucky to kill a marten. Many animals possess the power of curing diseases. Three hairs taken from the "cross" of an ass, that is the mark running up the back and out at right angles over the shoulders, will cure whooping-cough, but the ass will die. Another sure cure for whooping-cough can be obtained by asking and following the advice of a man riding a piebald horse. Swedish sailors will not mention the name of the port for which they are bound.

**Switzerland.**—If a huntsman, on going out in the morning, sees a fox cross his path, or meets an old woman or friar, he immediately returns home again; as he is persuaded that, in the first instance, he will meet with no game, and in the other that he will shoot a man hidden in the leaves, or do some other irreparable mischief. In the Alps the mountaineers believe that if the cuckoo sings in the direction of the north, it will rain the next day; but if toward the south, the weather will be fine. In the Tyrol if a young girl look pale and sickly his parents suspect that the moon-rays must have found their way into her bedchamber.

**Turkey.**—In Turkey if a cat enters a chamber where a person is dying and manages to pass over his or her body before being driven from the room, both the dying person and the cat become vampires and live ever after by sucking the blood from living people. If one finds a piece of bread lying upon the ground he must pick it up, kiss it and carry it until he finds a hole into which it can be inserted. To step upon a piece of bread or to leave it lying upon the ground is one of the unpardonable sins and dooms the offender to the third hell, where he is perpetually gored by an ox that has but a single horn, and that in the centre of his forehead. The Turk is convinced that misfortune hovers where he sees a rose leaf fall to the ground, and many people pay particular attention to the flowers and leaves which are decaying, gathering them carefully to prevent them from dropping.

**United States.**—In Michigan a double cedar knot is carried in the pocket by some to cure rheumatism, and in New Hampshire a man may carry a gall from the stems of goldenrod for the same disease. Hickory nuts, the buckeye and its cousin, the horse chestnut, which brings good luck in New Jersey, are other foes to rheumatism in different localities. Some people wear a strange ring made of a potato with a hole bored through it for rheumatism and others carry a plain potato in the pocket. The charm is more potent if the potato has been stolen. According to a Maine belief, a nutmeg pierced and hung on a string around the neck prevents boils, croup and neuralgia. In some parts of Massachusetts the cows are believed to forecast the future, and if they "moop" after midnight it is a warning of approaching death in the family. Among the West Virginia mountaineers the crowing of the cock before the door tells of coming company. It is believed on Cape Cod and in many other districts along the New England coast that a sick man cannot die until the ebb tide begins to run. In New England the sailors carry as a talisman a bone taken from a living turtle, a pebble from a fishhawk's nest or a small bone from the head of a cod. In Connecticut the belief holds that beans and potatoes must be planted in the old of the moon to prevent them running to vines. In Texas some superstitious people carry a small bone from a fish's head, but the luck only comes after the charm has been lost. See also *Amulets; American Mythology; Divination; Folklore; Gipsies; Medicinal Herbs; Pagan Rites and Customs and Hoodoo; Mexico — Mythology; Mythology; Omen; Talisman; Witchcraft, etc.*

**SUPPÉ, soop-pë, Franz von,** Austrian opera composer: b. Spalato, Dalmatia, 18 April 1820; d. Vienna, 21 May 1895. His musical ability early manifested itself and when he was but 13 years old he composed a mass which was sung at the Franciscan church at Zara. His first opera, 'Sommerachtstraum,' appeared in 1844. His best known works are the operas 'Patitnitta' and 'Boccaccio,' and his overtures 'Poet and Peasant' and 'Morning, Noon and Night.' He was for many years Kapellmeister at Vienna.

**SUPPLE-JACK,** the popular name given to various strong twining shrubs, for example, certain West Indian species of *Paulinia* and *Serjania* which furnish walking-sticks; or *Cardiospermum grandiflorum* or the high-climbing shrubby *Berecithron* where they range in the southeastern United States and has tough, terete branches, oval leaves, small greenish flowers in panicles and oval purple drupes, which render it conspicuous in autumn. The supple-jacks of Australia are climbing, woody
SUPPLEMENTAL EDUCATION

varieties of Clematis aristata, and that of New Zealand is one of the largest brambles known (Rubus australis), reaching to the tops of the tallest trees. It is also called the New Zealand lawyer.

SUPPLEMENTAL EDUCATION. Definition.—Extension education is for every community and for everybody. It extends the opportunity for education to the whole body of the people, to the whole period of life and to all the vital interests of life.

Formal education may be said to include the systematic instruction which is imparted through personal contact with the student, whether by class-room work or lectures, when given under the direct guidance and supervision of trained instructors in schools, colleges, universities and similar institutions, as distinguished from knowledge acquired through the more informal methods of study whether or not allied with teaching institutions. These methods vary widely and range from the carefully organized study clubs of university extension courses to the entirely independent research work of single individuals in libraries, museums and similar educational institutions.

General Purpose.---Universities exist for two purposes: (1) To perpetuate and discover knowledge; (2) to disseminate that knowledge both in its academic and its practical results. Extension teaching furnishes a means of furthering knowledge in both these aspects, particularly the practical.

By instituting popular instruction in those practical, technical and cultural subjects over which universities tend perhaps unconsciously to exercise a monopoly those institutions can so influence public taste and intelligence as to contribute greatly to social progress. Nalder.

The chief object of extension work is to provide the best education possible at the lowest practicable cost for those who are unable to attend established educational institutions.

I. Systems.---University Extension.---History.—As early as 1831 some forms of university extension were in use in the United States in the work of the American National Lyceum, an organization which, though not associated with any educational institution, had a part in the wide spread of popular education. Lecture courses and debating clubs were begun in many city and country communities. In 1887 an address before the American Library Association on the subject of the English system of university extension aroused much interest, and as a result university extension work was begun in several cities in connection with the work of the city library. In 1889 Columbia University announced to the teachers in and near New York City the offer of certain elementary courses in science, to be given by means of classes outside the university. From this beginning university extension grew steadily as a power in popular education.

Purpose and Scope.—University extension provides a means for the acquirement of an education by those who for any reason are unable to attend the various colleges offering formal instruction. The courses are designed not only to assist such persons but also to supplement the regular work of such institutions by offering an opportunity for continued study to those who may have completed the formal courses.

Extension courses cover a wide range of subjects from those of a very elementary character to those which are of interest and benefit only to a highly educated and cultured class, the courses being adapted to the particular need to be met. In many instances it is difficult to make a clear line of distinction between university extension and the formal instruction of teaching institutions as exemplified in night schools and vocation schools.

Methods.---Extension service as carried on by the universities of this country varies widely in methods. In some institutions there is a separately organized extension faculty entirely distinct from the regular faculty, while in others extension work is conducted by the regularly organized faculties through the medium of the various departments. The former plan, which is relatively more expensive, provides for a highly specialized and intensive type of work, but the other secures co-ordination of effort by the various departments and co-operation on the part of the faculties that would otherwise be impossible.

1. Lectures and Classes.—More or less lecture work is offered in most of the institutions which do extension teaching. Several forms of such work are employed, in some cases all are used in the same institution while in other cases one form may represent the entire work of the institution along extension lines. One form of lecture work is the lecture class—often these classes are held on Saturdays or late in the afternoon of other days for the benefit of students who are fully occupied during the hours of the regular college classes. Frequently the lectures are given by members of the faculty, also by men engaged especially for the work and by local experts in particular lines. One of the chief developments in the establishment of local classes throughout the country has been in connection with engineering work. Classes have been formed in shops and factories, and short courses offered at a number of colleges and universities.

In California out of 300 classes held under the direction of the University of California in eight cities, more than 200 classes were in San Francisco alone, showing to what an extent extension service may contribute to the intellectual, industrial, social and commercial life of a great modern city.

The welfare work of university extension is based upon the theory that there is a large field of human interests, specifically social in their nature, which is not covered by any other public educational agency. Such interests are those of health, municipal affairs, a public forum, the music interests of a community and the promotion of the economic prosperity of the small town. Many other topics might be mentioned but these are typical and are the more easily organized and directed.

Extension work in home economics seeks to conserve the home through teaching and training the individuals who compose it. In the South there are nearly 1,000 women who are devoting their entire attention to Southern States. South Carolina has 45 county agents and 20 cotton mill villages organized for community improvement.

The extension work of normal schools includes all forms of educational activity carried
on by the normal schools among people who are not enrolled as resident students in the regularly organized classes. The extension work of these schools differs principally from that of the universities in that it lays special emphasis upon the study group or local class method, not upon correspondence work.

2. Study Clubs.—Some of the first steps in university extension were taken in the State of New York and it was the first State in this country to make university extension a part of its educational system. A special feature of the work was the development of the library system in all its branches. Through the traveling libraries division of the University of the State of New York, large collections of books were sent out as early as 1894 to university extension centers for the use of the study clubs formed in connection with the lectures. From this beginning has grown the present widespread use of the traveling libraries by hundreds of study clubs throughout the State.

The discussion of public questions of importance and interest has been encouraged and stimulated by the establishment of a service which supplies current information and data on live topics of the day. Package libraries consisting of books, pamphlets, clippings, and typewritten material on important social, economic and political questions, on the principles of debating and on the organization and conduct of debating societies are supplied freely to clubs, debating clubs and similar organizations. Local libraries co-operate by furnishing available material and in some instances, notably in the case of the New York State Library, the work is carried on directly under the jurisdiction of the library. This work has been very fully developed at the University of Wisconsin.

4. The Co-operative Plan.—The co-operative system has been defined as the co-ordination of theoretical and practical training in a progressive educational program. One of the reasons why the night school has not been able to cope with the problem of the illiterate of the adult worker with entire success is because it frequently does not connect his education with his work. Co-operation between school and factory whereby manufacturers agree with the school authorities to carry on apprenticeship courses in practical trades while the school gives generalized and special instruction, has already met with practical success. In the co-operative plan the students frequently work in pairs; while one is at the office, shop or laboratory, the other is at school, the two changing places weekly. Courses are properly called "co-operative" because they enlist the active co-operation of the outside practical world in directing some of the educational policies of the school. At the present time there is a growing tendency on the part of manufacturers, department store managers and others to conduct, often during business hours, classes for their employees along the lines of their specific forms of business or on general elementary subjects of education. Such schools are described more fully elsewhere under the subject of Corporation Schools.

Principal Present Day Agencies.—Of the many institutions conducting university extension courses at the present time among the most notable ones are the University of Wisconsin, University of Michigan and Columbia University.

1. Wisconsin.—The University of Wisconsin offers several plans of extension work for the benefit of persons who desire to study any subject as members of a club, class or study group and provides special guided outlines. Such co-operative study makes possible personal visits and class instruction from university professors and specialists. These plans are adapted to the needs of teachers' groups, women's clubs, labor unions, farmers, business men's associations, etc. The outlines which are provided carry the privilege of a lecture or series of lectures and of direction, guidance and assistance by the person who outlined the work. Because of this provision the studies are much more effective and interesting. There is a nominal charge for outlines with the attendant privileges and there is an increasing demand for this service. Recently a Chautauqua circuit has been established in the State for the purpose of providing instruction, inspiration and recreation.

Community institutes are held in various parts of the State to assist local communities to solve certain definite problems. These institutes are in charge of men specially trained in the economic and social problems common to small country communities.

The university in its extension work has free access to the Legislative Reference Department, the State Historical Library, the University Library and the City Library. The Wisconsin Free Library Commission and those in charge of the different libraries co-operate generously in this work. Bulletins are issued, bibliographies and study outlines are prepared and publications are supplied gratis in the State. The Wisconsin Civil Service Commission has co-operated with the university in educational work among State employees by means of conferences, talks, lectures and in various other ways.

2. New York City.—In New York city a plan is being followed of training persons already in the city public service through the co-operation of the College of the City of New York and the city government. In 1917 a thousand city employees were studying 1,300 courses in the evening classes. The College of the City of New York in cooperation with the board of education offers free extension courses in several centres to the teachers of the New York City schools.

3. Columbia University.—The extension teaching department of Columbia University offers many courses in subjects which form a part of the curriculum of Columbia College and in the more advanced branches of these subjects shares in the work for the higher degrees. Subordinate and subsidiary to this are the courses of secondary school grade for mature students who cannot return to ordinary schools of this type. The professional schools are represented in an increasing number of
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courses so that students may pursue their studies in many special branches. In addition to the regular courses of the extension teaching department extramural courses in New York and in outlying cities are offered.

4. Other Agencies.—One that is attempting to reach working people along educational lines is the Young Men’s Christian Association. The subjects pursued in the Y. M. C. A. classes may be approximately grouped under six heads: (1) Commercial; (2) political; (3) industrial; (4) physical; (5) language and miscellaneous—music, first aid to the injured, etc.; (6) special schools, such as law, art, automobile, etc.

The Young Women’s Christian Association also has educational classes but comparatively little instruction is given in the regular high school subjects. The main effort is to help women who are self-supporting to become more efficient and to put within the reach of those who are not self-supporting the training which will assist them to a greater extent.

The University of Michigan endeavors to conduct its extension service as far as possible through established university channels. Its policy is to render through its extension division possible all the great labor of a public service commensurate with the equipment and facilities of the university. It is a condition that all extension lectures shall be free to the public and that they shall be so advertised. In one year 1,300 reprints were made for the 300 lectures offered. The total number of auditors reached throughout the State in the year was 71,500.

II. Home Education.—Definition.—There is no distinct line of demarcation between what is termed university extension and home education, but in general the former may be said to provide for the giving of instruction to groups or classes rather than to individuals. The work is conducted for the most part by teaching institutions by means of lectures and other methods which are not comprised within the lines of formal education. It is the extension of the teaching power of an institution beyond the boundaries of regular class-room work. Home education is that which can be acquired in the home independently of association in groups or classes. It embraces all means of obtaining knowledge which are individual in their nature as distinguished from education acquired through association with other individuals by means of classes, study clubs, lectures, etc. Correspondence schools, reading courses, libraries, museums and other similar sources all offer a means of securing an education without the formal instruction associated with class-room work.

Purpose.—A very large proportion of our people leave school before completing either the high school or grammar school course. Within a few years many of these people realize their educational limitations but because of age, hours of labor, financial condition or other cause it is impossible for them to resume a course of study in an educational institution. University extension courses and home education facilities are designed to meet the needs of such persons and of all who for any reason desire to continue their studies. The recent increase in the number of persons taking correspondence courses is the best testimony of the need of educational facilities to supplement those of our regular schools, colleges and universities. To obtain an education through individual effort without the personal guidance and inspiration of a teacher requires determination and perseverance, and those who take advantage of these supplementary educational opportunities show evidence of a real desire and serious purpose to acquire an education. There are certain benefits to be derived from formal education which cannot be obtained in any other way, but the serious and ambitious student may find in the United States ample opportunity to pursue his studies in his leisure hours at little or no expense.

Methods.—1. Libraries.—These are well termed “the people’s university” for they constitute the most universal, most accessible and most economical source for self-education. They are storehouses of knowledge which is made readily available to readers by modern methods of classification and indexing. Nearly all large libraries in this country are equipped with the latest and best bibliographical aids so that the student has every possible means of assistance at hand. Our libraries are frequented more and more frequently by people, increasingly frequented by those seeking information on all sorts of subjects. Ordinarily only such restraints with regard to the use of the books are imposed as are necessary to protect the rights of readers, and serious students are frequently granted special privileges. Within recent years all libraries have become much more liberal in their service to the public and have been transformed into active rather than passive educational institutions. “There is a sense in which the school may be looked upon as a fairer test of community opportunity than the library. The school is compulsory; it impresses people most during their most impressionable period. On the other hand the library reaches old as well as young. Once established it remains as a centre for the distribution of knowledge and hence of opportunity.”

2. Traveling libraries.—In some States library facilities, to a certain degree at least, are at the disposal of every citizen even though there may be no library in his local community. This distribution of books is accomplished by means of traveling libraries in some cases and in others by sending books by parcel post or express from a central public library or agency such as a State library or library commission. In the State of New York both methods are in use, the traveling libraries having been in operation since 1893. These traveling libraries are small collections of books, usually in units of 25 volumes, which are sent anywhere in the State without charge on condition that the books shall be for the use of the public. These libraries are intended primarily for communities without any free library facilities but under certain conditions they are sent also to small public libraries. There is a wide use of these libraries, aided by state agents and various organizations, and many “house libraries” of 10 volumes are borrowed by individuals. Institutions or individuals wanting only a few books for a month or less may procure them from the New York State Library by paying the return transportation charges. By means
of this library extension service any citizen of the State may secure books either free of all charge or at a merely nominal cost.

3. Reading Courses.—Reading courses on various topics are prepared and made available by libraries, schools, institutions, and governmental departments of education and by means of these guides to study, the individual is enabled to inform himself fully on the subjects covered by the courses.

The Home Education Department of the United States Bureau of Education work is carried on largely through personal correspondence and through the dissemination of reading courses. In 1917 there were 10 courses offered and approximately 100,000 copies of the printed outlines were distributed during the year. The bureau has been able to secure the co-operation of libraries and library commissions in bringing these courses to the attention of the public and in carrying on the work. More than 6,000 persons are now enrolled in the National Reading Circle and certificates are granted to persons completing the courses.

4. Museums.—The rise of the museum as a new force in town, city, state and nation is one of the educational factors of educational evolution. The growing museum influence which during the past quarter of a century has been especially remarkable throughout the cities of the United States is largely due to what may be called the new museum idea, namely that the museum is not a negative but a positive educational force and that it has teaching qualifications peculiar to itself. The most important function of a public museum is that of usefulness to the public in an educational way. With the great resources at their command museums are working out plans of various kinds for the definite instruction of the public, such as study rooms, illustrated lectures in the museum or elsewhere, tours of the museum under trained and competent guides, and loan collections.

One of the most interesting and important developments is the Children's museum, or Children's room which is one of the results of the growing conviction that the museum is a public institution which should meet the needs of all ages and classes of people.

5. Correspondence Courses.—Certain universities have especially emphasized correspondence-study work. At those institutions where this form of instruction has had the longest trial statistics show that the students who take advantage of the opportunities offered by these courses to do a certain portion of the work required for a degree cannot be classified among those who are seeking easy methods for gaining a degree. The students by and large are rising in the average grade of class-room student. The subjects offered are mainly cultural; those courses for which there has been the greatest demand include the languages, mathematics, history, education, political economy and technical subjects. A large number of biblical and theological courses are offered by some institutions.

Correspondence schools also play a large part in Home Education, but instruction by correspondence can never take the place of class instruction for it lacks the inspiration of personal contact. As a means of helping am-
correspondence study reaches literally every part of the world. Through the Correspondence Study Department the university offers a large number of the courses given in the classes of its different divisions, and all non-resident work for credit is conducted through this department. Each course is designed to be equivalent to the corresponding residence course and calls for an equal amount of work. No preliminary examination or proof of previous work is required of applicants for correspondence work. At the Pennsylvania State College correspondence courses are offered in agriculture, home economics and industrial education, free of charge to any citizen of the State. Students at the summer session are permitted to complete their work for certain subjects by correspondence at a nominal cost. At the University of Wisconsin 300 single courses are offered in 28 departmental lives and 70 of these courses are open to extension subjects. Each course is divided into units designated as assignments and each assignment represents six to eight hours of work. The instruction is carried on in three ways: by special letter notes, by correction of the exercises submitted, by personal letters and other assistance where special needs are otherwise met.

Education of Adults in Other Countries.

Schools for the education of adults originated in England through the Sunday School movement during the 18th century. The first adult school was opened in Nottingham in 1798 and has continued to the present day. The movement soon spread to other parts of the country and though providing secular instruction it was religious in its association. Parallel with these schools were classes in scientific and civic subjects. In 1831 the English government made pecuniary grants to evening schools. At the beginning of the 20th century out of every 1,000 of the population of England and Wales about 23 persons voluntarily attended some form of evening class on work days. Several agencies have been influential in the development of this movement — namely the Union, the National Home Reading Union, the Y. M. C. A., the Recreation Evening Schools Association and the Worker’s Educational Association.

England had in 1918 a new education bill which provides for national oversight, national direction and compulsory attendance of children from five to 14 years of age, for part time continuation schools for those between the ages of 14 and 18, for medical inspection, physical training and more than 30 other incidental aids to democratic education — this bill will revolutionize education in England.

University extension as a means of carrying higher education to adults has had an unparalleled success in England and the progress of the movement has been remarkable. Instituted by the University of Cambridge in 1827, adopted by Oxford in 1878, taken over by the reconstituted University of London in 1911 — these three universities are the world-wide acknowledgments of a priori merits of the movement. The original form of university extension teaching has not declined in England as it has in the United States. The characteristic features of the lecture system at local centres, with a class following the lecture and a final examination, have been maintained. Taking Oxford and Cambridge, 500,000 students have attended the courses given in nearly 40,000 lectures by over 200 lecturers and nearly 30,000 students have been examined.

One of the most far reaching educational results of the war of 1870, with its great lesson of the importance of national education, was the law of 1873 passed in Saxony making attendance at continuation schools compulsory for three years (that is up to 17 years of age) in that kingdom. The Saxon law appears to have been justified by the experience of a generation. There is no doubt that in this matter of continuation schools, as in so many other fields of social organization, the adoption of compulsion has been facilitated by the habituation of the working classes to compulsory military service.

Adult education forms an important part of the educational work of Denmark also. Children of ability who can pass the required examinations are sent from the communial schools to the middle school, gymnasia and university at State expense. Most other children go to work after five years at school but a fair percentage of them go to evening classes not only for technical training but also for higher education generally, and many attend University Extension lectures regularly for years after they leave school. A great social educational movement was started in Denmark in the late 80’s. The primary object of this movement which was organized and is still worked by students of the Copenhagen University, with the cordial help of the professors, is to draw together the diverse sections of the community, to weave bonds of friendly sympathy between them and to spread the light among even the lowest sections. Students hold night schools in the Copenhagen communal day schools and give lessons there gratis to all the working men and women who care to go. There are more than 3000 teachers and more than 2000 are taught. On Sunday are free popular lectures by students and professors to which the working classes flock in thousands. The Danes boast that in their country there is no ‘unenlightened class’ and they do so with good reason.”

William R. Watson,
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SUPPLEMENTARY PROCEEDINGS

are in the nature of a civil and equitable action whereby property of a judgment debtor may be reached, where said property cannot be taken under the usual process of execution; its object primarily is to discover the property of a judgment debtor which is subject to execution, and to learn if the debtor possesses or controls any property which is applicable to the satisfaction of the judgment. Any creditor who has reduced his claim to a judgment and issued execution thereon may institute supplementary proceedings, and the first creditor who does so and prosecutes the proceeding with due diligence obtains a prior lien over the property to which the creditor has a lien. Supplementary proceedings exist and are regulated according to the statutes in each State:
SUPPLICANTS—SUPPRATION.

SOME jurisdictions afford much the same remedy through other means. In the U.S., they do not allow the remedy against corporations. In some jurisdictions certain classes of property are exempt, as, for example, wages earned by the debtor within a specified time next before the institution of the proceedings, the period varying in different States. Orders for examination in supplementary proceedings are granted by a judge having jurisdiction according to the statutes under which the right to maintain the proceeding is derived and may be held before a judge or referee appointed for the purpose; this order must be served upon the person to be examined and it may be set aside on account of any defect but otherwise must be complied with. If, from the examination, it appears that the judgment debtor has in his possession or under his control property or money by which a judgment may be satisfied, the judge may, in his discretion, direct the debtor or person holding said property for him to deliver the property to a receiver for the purpose of applying same to the judgment. One who disregards or defies the orders of the judge in those proceedings is subject to punishment for contempt.

SUPPLICANTS, the name assumed by the Presbyterian petitioners against the introduction of Archbishop Laud's Service Book and the Book of Canons into the Church of Scotland; as their petition had no effect the Suppliants in 1638 signed the National Covenant and Confession of Faith, which year were ratified by the General Assembly: thereafter they were known as Covenanters (q.v.).

SUPPLY RAILWAYS. Under this designation are included all railways, except combat railways, that may be constructed or used for the supply of an army in the field. They may vary from a light portable track to a standard-gauge road. Their principal uses are to connect the army with its base; to connect permanent gun emplacements near the main line of resistance and for the movement of troops and supplies between bases and on the GOVERNING. In extreme cases a railway may have to be constructed to supply an advancing army when local conditions preclude other means of transportation.

Regardless of the gauge, the same underlying principles govern the construction of all such lines, and having a plan for the operation and maintenance of an existing line of railway, it is easy to adapt it to the requirements of a temporary line. The principal considerations that govern in planning such lines: (1) the amount of army supplies, troops and animals that must be handled; (2) the time that can be permitted for its construction; and (3) the amount of transportation necessary to place the railway supplies on the work which applies permanent roads. In the latter case the condition ordinarily necessitates a narrow-gauge railway for a supply railway in a country beyond the sea. Local conditions, such as a large supply of standard-gauge material and the ability to render advisable the building of a standard-gauge railway for operations from a friendly land base; but where conditions extremely favorable to a standard-gauge line do not exist, a narrow-gauge railway will probably be decided upon in the general case of supply railways. The weight of the materials and rolling stock is so much smaller, the bridges can be so much lighter, and the earth work is so much less than for a standard-gauge road that the narrow-gauge railway is decidedly easier and quicker to build.

In case an official report is desired by the commanding general before he decides whether or not to construct the line, the entire survey and the estimates must be finished before the report is made. This report is accompanied by maps and profiles showing the routes considered and the final location decided upon, and the reasons therefor. It also shows the approximate cost of material and of civilian labor, the amount and cost of rolling stock and other equipment, the capacity of the line when it is completed and the time that will be necessary to complete the work as desired. In case it has been definitely decided in advance to build the line, the cost and time are only considered in that they must be kept as low as practicable, and the survey need not be completed before construction work begins. See MILITARY RAILROADS.

EDWARD S. FARROW, Consulting Military and Civil Engineer.

SUPPOSITORY. A medicinal compound prepared in the form of a cone, space, or cylinder, for introduction into the rectum, urethra or vagina, there to be dissolved (melting gradually by the heat of the body) for the purpose intended, as action on inflamed mucous membrane, evacuation of the bowels, etc.

SUPPURATION. A morbid process in animal tissues which gives rise to the formation of pus. It is one of the destructive terminations of inflammatory action. The inflammatory leucocytes, instead of being dispersed (melting gradually by the heat of the body) for the purpose intended, as action on inflamed mucous membrane, evacuation of the bowels, etc.

The pus-globe shows more distinct trace of a membrane, and is frequently many-nucleated when treated with acid, a condition which Winkelmans regards as indicating a tendency to degenerate and break down. Many of the corpuscles of pus discharge no difference in character from the blood-leucocytes, having only single nuclei, showing the same amoeboïd movements, and being in fact obviously the same things both in structure and function. Suppurative is not, in most cases, wholly a destructive process, but serves to liberate the usual modes of repair. The result of the process of suppuration is thus twofold, being in part destructive and in part constructive. Suppuration in the interior of the body usually terminates in the formation of a suppurating ulcer, in which cases the matter is diffused through the interstices of the part, and is termed diffuse inflammation.
SUPRALAPSARIANS. See supra-lap-sa-ri-anz, those Calvinistic theologians who maintain the strict doctrines of Predestination, Election of Grace and Reproduction, namely, that the Creator for His own glory decreed the fall of man and the execution of sin into the world; and that the election of some to everlasting life and the damnation of others was made beyond (or before, supra) Adam's fall, and was in no way consequent on it or dependent upon it. See Predestination.

SUPRANATURALISM. See Supernaturalism.

SUPRARENAL CAPSULES. Two small, ductless glandular bodies situated at the front portion of the upper end of each kidney. They are generally classified with the spleen and similar structures as ductless glands. Each suprarenal capsule exhibits a yellowish color. That of the right kidney is somewhat of triangular shape, the left being of somewhat crescentic form. In some cases these bodies may be hardly recognizable on account of their minute size. Their average weight is from one to two drams. Each capsule is connected to its kidney by a pedicle of tissue only no vascular or other connections existing between the glands; and neither capsule has any outlet or excretory duct. They lie behind the peritoneum, or lining membrane of the abdomen, the front surface of the right suprarenal capsule being in contact with the under surface of the liver, the same surface of the left being in relation with the pancreas and spleen. The capsules derive their blood from the aortic, renal, and phrenic arteries, and return their blood by the suprarenal vein, which receives its blood from the net-work of the medullary portion, and also partly from the cortical substance of the organ. The nerves of the suprarenal capsules are numerous, and are branches of the solar and renal plexuses and of the phrenic and psoas trunks. The suprarenal capsules are present in all mammals, and are largest in Rodentia, and smallest, proportionally, in the whales, in which they are lobulated or divided into lobes. In birds of small size, and exist generally on the inner aspects of the kidneys. In sharks they exist as a single, long, lobular organ lying behind the kidneys; and in frogs and toads they appear as yellowish patches on the kidney. They are also lobular in sturgeons and other fishes, and in newts and Urodela generally. That these bodies may have some important function to discharge in connection with the blood-circulation of the embryo is a highly reasonable suggestion; but further than this general statement physiology cannot certainly proceed. Facts of much interest in connection with these bodies, however, have been observed in cases of Addison's disease (q.v.). The actual diseases to which these bodies are liable consists of hypertrophy or enlargement, atrophy or wasting, tuberculous degeneration, fatty disease and occasionally cancerous infiltration.

SUPREMACY. Royal, as a term in English law, is practically restricted to denote the authority of the Crown in matters ecclesiastical. After the abolition of the papal supremacy at the English Reformation, the royal supremacy was confirmed by various acts under Henry VIII and Elizabeth, all enforcing an oath of supremacy. The oath was taken by holders of public offices along with the oath of allegiance, and afterward with that of abjuration, until the three were consolidated in one. The revised oath of allegiance imposed upon members of Parliament, and the affirmation or reafirmation of royal supremacy in ecclesiastical matters. Supremacy acts were passed in 1534, 1559 and 1689.

SUPREME COURT OF THE DISTRICT OF COLUMBIA. See Court.

SUPREME COURT OF JUDICATURE. A legal tribunal in which are united all the higher courts of justice in England, exclusive of the appellate jurisdiction of the House of Lords and of the Privy Council. It dates from the Act of 1873. See Court.

SUPREME COURT OF THE UNITED STATES. The, is a cardinal feature of our Federal representative government, balancing and harmonizing all its parts, a tribunal which has received the general approval and admiration of foreign jurists and statesmen, and commands the universal respect and obedience of the people for whom it administers justice. The Federal Convention of 1787, which framed our Constitution and created this unique tribunal, was composed mostly of members of the legal profession, who had always in America been the chief nursery of statesmen; but Washington, the soldier, presided and Franklin, the philosopher, advised at every step. The members of the convention were undoubtedly chosen from the best qualified men that the country could furnish for the momentous work which was set before them, and their merits have been so universally recognized that it is not necessary to repeat any of the emphatic tributes which any Englishmen have paid to the results of their labors. Their work was finished in four months' secret session at Philadelphia, but most of them had been in training for it through 20 long years of trial and trouble. From 1765, the time of the passage of the Stamp Act, which was passed through both Houses of Parliament with little opposition, the colonists, and especially the lawyers of the Colonies, had been careful and earnest students of the principles of free government.

In 1774, having exhausted in vain all appeals to king and Parliament for a redress of their grievances, they sent delegates to a Continental Congress to deliberate on the state of public affairs; and in this Congress, which lasted for seven years, many of the future framers of the Constitution who were members of it found a most instructive school of statesmanship, and constantly devoted themselves to the social and political education of the colonists in matters of government and of public law and popular rights. In 1776, as the representative of the United States of America in General Congress assembled, appealing to the Supreme Judge of the world for the rectitude of their intentions, they did, "in the name and by the authority of the good people of the Colonies, solemnly publish and declare that these United Colonies are, and of right ought to be, free and independent States; that they are, and of right ought to be, absolved from all allegiance to the British Crown; and that all political connection between them and the State of Great Britain is, and ought to be, totally dissolved." They declared
that as free and independent States they have full power to levy war, conclude peace, contract alliances, establish commerce, and to do all other acts and things which independent States may of right do, and for the support of this declaration, with a firm reliance on the protection of Divine Providence, they mutually pledged to each other their lives, their fortunes and their sacred honor. From the hour of the Declaration, the men who made it, and all the other citizens of the Colonies, had to give re- marks and constant study to the whole science of government. As they proved able by force of arms to make good this declaration, the United Colonies became from its date a new nation, over which Congress, by general consent and acquiescence, exercised the powers of a general government, for all the purposes of the very serious exigency which had called it into existence. But it was a government by Congress only, with feeble and undefined powers, without an executive and without a judiciary. While the war lasted it barely sufficed, and afforded daily object lessons of its own defects and of what was required for a better government when better days should come.

The several States, being dissolved from the royal charters under which they had before practically managed their own affairs, adopted written constitutions, based in each case upon the sovereignty of the people, to take the place of the former dominion of Parliament. An epoch of constitution making set in, during which the principles of representative popular government were discussed and understood. Virginia, the largest of the States, the home of Washington, Jefferson, Madison and Monroe, who were to be four out of the first five Presidents of the United States, took a leading part. New Hampshire had already framed a temporary form of government "during," as they said, "the unhappy and unnatural contest with Great Britain." South Carolina and New Jersey had followed, but in the case of the former it was expressly declared that the Constitution established was "established until an accommodation of the unhappy differences between Great Britain and America could be obtained."

Massachusetts, in 1780, with the utmost pains and deliberation prepared and adopted a complete Constitution, in which the powers of government were carefully distributed, with the solemn declaration that neither the legislative, executive or judicial department should ever exercise the powers of either of the others "to the end that it may be a government of laws and not of men." During the war the other colonies were engaged in the same business of founding States upon the principles of civil and religious liberty, embodied in written constitutions. Rhode Island alone, founded by Roger Williams, the great apostle of toleration, having received from Charles II in 1603 a royal charter, preserved it until 1784 without adopting any written Constitution.

But it was not only in the individual States that the framers of our Constitution were in all those years gathering knowledge and experience, with a view to a consummation. From the very date of the Declaration, Congress, conscious of the inadequacy of its powers, even for the purposes of carrying on war and conducting foreign affairs, entered upon the novel and difficult task of arranging a scheme which should enable it more efficiently to conduct those affairs which were of common interest to all the people of the 13 States, and which no one of them, nor all of them individually could control. After two years they adopted an instrument of government by which they styled "Articles of Confederation and Perpetual Union," but it was not until March 1781 that the powers of Congress were enlarged by the final ratification of these articles by the delegates of all the States. But this attempted bond of union—a crude experiment in the formation of a national government—proved little better than a rope of sand, and utterly failed to accomplish the purposes intended. While the war lasted the tremendous pressure of their common danger and common distress kept the States together and made them obedient to the request of Congress which really had no power to command, but as soon as this external pressure was taken off, they fell apart, and each asserted its independent sovereignty. So jealous were the States, which had just escaped from the dominion of one central power, of anything which should seem to create dominion over them in another, that although upon paper they had laid many restraints upon their own actions, and conferred upon Congress extensive powers over their Federal affairs, they had carefully refrained from giving any sanction to those powers and from granting to Congress the means of compelling obedience to its enactments. The Articles provided for no Federal executive and for no judiciary department, although they authorized Congress to provide for the settlement of boundary disputes between States and to appoint courts of prize and for the trial of piracies and felonies on the high seas. Moreover, Congress could not of its own authority raise a dollar of money for revenue or a single man to recruit its armies. It could only make requisitions for men and money upon individual States, which met them or not as they found it convenient. Nor could it proceed at all in the exercise of the principal powers nominally conferred upon it until nine States assented to the same. One of the leading writers of the same thus describes the powers of Congress under this Constitution:

*By this political compact the United States in Congress assembled have exclusive power for the following purposes, without being able to execute one of them. They may make and conclude Treaties, but can only recommend the observance of them. They may appoint Ambassadors, but cannot defray even the expense of their tables. They may borrow money in their own name on the faith of the Union, but cannot pay a dollar. They may coin money, but they cannot purchase an ounce of bullion. They may make war and determine what number of troops are necessary, but cannot raise a single soldier. In short, they may declare everything, and do nothing.*

Judge Story says that, strong as this language is, it has no coloring beyond what the naked truth would justify. As John Adams himself wrote: "The Confederation appears to me to be little more than a shadow without the substance, and Congress a nugatory body, their ordinances being little attended to. Of course, under government, the public affairs drifted steadily and rapidly from bad to worse. Interest on the public debt could not be paid, nor the ordinary expenses of government be provided for. The treaties which had been made could not be carried out, and
foreign nations would not deal in the way of new treaties with the envows of a body which had no head and no power to perform what they should agree to in its behalf. Our external commerce was at the mercy of foreign nations, whose laws contrived for its destruction, Congress could do nothing to counteract. And worst of all, our domestic commerce, which between the citizens of one nation should be free and equal, was in the mercy of the cabals or selfishness of each individual State. There were many boundary disputes between States which threatened civil war. Federal laws were a dead letter, without Federal courts to expound and define their true meaning and operation, or an executive to see that they were properly executed. There was a general failure as yet to realize in actual enjoyment the advantages we had won by seven years of war, and everything seemed drifting toward bankruptcy, disunion and anarchy. But that was the whole power and resources of the evils which resulted from them, demanded the constant exercise of the best brains in all the States to understand and to remedy them, and opened a new school for all our statesmen in the study of constitutional government. When Washington had laid down his sword and surrendered his commission to Congress, after the signing of the treaty of peace which acknowledged the independence of the United States, he exhorted his countrymen by all they held dear to provide for the establishment of a strong and stable government as the only hope of retaining the liberties they had won; and from that hour until the Federal Constitution was made and ratified he and Hamilton, and Franklin and Madison, and all the other great statesmen who made it, or helped to secure its adoption, were engaged in the constant study of the principles of free government and in enforcing them upon the attention of their fellow citizens, so that they came to the performance of their great duties in the Federal Convention as graduates of the best practical school of Constitutional Law that the world has ever seen.

Their allotted task was to create a National Government which should reach, for its own proper purposes, by its own power, every man and every foot of territory in the whole United States, and should at the same time leave untouched and undiminished the complete control by each State of all its internal and domestic affairs—which should be entirely adequate without aid from the States, to govern the people effectively in all matters that involved the general interests of all, to deal with foreign nations and the people of the entire people behind it, in all the exigencies of peace and war, and to accomplish all this with the least possible vesting of arbitrary power in any department or officer of the new government. They differed in opinion and sentiment on many points, but all agreed in a supreme dread of arbitrary power, whether it should be exercised by the executive, the legislative or the judicial department, whether by a single man or by a majority of all, for they considered that the majority would have no restraints upon its power might become quite as dangerous as any other despot. They did not believe with my Lord Coke that absolute despotic power must in all governments reside somewhere. They carried this distrust of arbitrary power so far that they committed to the hands of the people, whom they regarded as the source of all political power, and deprived them of the right to consider any amendment of the Constitution until it should be proposed by a vote of two-thirds of both houses of Congress or by a Convention called by Congress, on the application of the legislatures of two-thirds of the States, and deprived them of the power of voting directly upon any amendment, which could only be ratified by the legislatures or conventions of three-fourths of the States.

In other words, the people of the United States who ordained the Constitution, deprived themselves of the power to modify it by the direct vote of a majority or two-thirds or even three-quarters of their own numbers, whether that number should be 3,000,000 or 80,000,000. They must act deliberately and indirectly through Congresses, legislatures, conventions and primary elections. Truly a rare instance of political self-restraint at the hands of a popular government. One of the best definitions of the objects of such government is contained in the preamble of the Constitution:

"We, the People of the United States, in order to form a more perfect Union, establish justice, insure domestic tranquility, provide for the common defence, promote the general welfare and secure the blessings of liberty to ourselves and our posterity, do ordain and establish this Constitution for the United States of America."

It was to "establish justice" for the people of the United States that the Federal judiciary, with the Supreme Court as its head, was created. It forms the balance wheel by which the affairs of the nation and its relation to the States are kept in working order, and is itself held in check by the power of the President to appoint its members as vacancies may occur, and by the power of Congress to impeach them for misconduct, to regulate the measure of its appellate jurisdiction and to increase or diminish its numbers. The permanent stability of the judicial power is assured by its being imbedded in the Constitution, with a representative body, find with that of the executive and legislative departments, by the extreme difficulty in the way of any amendment that would impair it, and by the universal conviction which the experience of a century has produced, that its continued existence with the full enjoyment of its present functions is absolutely essential to the successful working of our scheme of popular representative government.

The great achievement of the framers of the Constitution, was so to distribute the powers of government between the States and the Nation, as to give the latter supreme control over all subjects that concerned the general interests of all, and reserve to each of the former exclusive control over local affairs which concerned only its own territory, and do this in such a way that the State and Federal administrations should not clash in actual operation. They knew the importance of a distribution of the powers of government between the three great departments. They created a Congress on which they conferred legislative powers over 18 enumerated subjects,
necessarily involving the general interests of the people of all the States and essential to national sovereignty, including the levying and collection of taxes for Federal purposes, the borrowing of money, the regulation of commerce with foreign nations and among the several States, the coining of money, declaring war, raising and supporting armies, and maintaining a navy. They placed such limits upon the exercise by Congress of legislative power as should prevent its interference with legitimate local administration by the States, or with the fundamental rights of the citizens, and put such prohibitions upon the legislative power of the States as should prevent their interference with the general powers and functions of the Federal government. They vested the executive power of the Federal government in the President, who was made commander-in-chief of the army and navy and of the militia of the States when called into the service of the United States. He was granted power to proclaim reprisals against a State, to make treaties, provided two-thirds of the Senate concur, to have a veto power over acts of Congress, which could be overridden only by a vote of two-thirds on reconsideration. He was also to nominate, with the advice and consent of the Senate, ambassadors, judges and all the principal officers of the United States, to recommend to the consideration of Congress such measures as he should judge necessary and proper, to commission all officers of the United States, and to take care that the laws should be faithfully executed.

And, finally, to secure the absolute supremacy of the Federal government over all matters of Federal cognizance, it was expressly provided that "this Constitution and the laws of the United States, which shall be passed in pursuance thereof, and all treaties made under the authority of the United States, shall be the supreme law of the land, and the judges of every State shall be bound thereby, anything in the Constitution or laws of any State to the contrary notwithstanding." This making the Federal Constitution and treaties made, and laws of Congress passed under its authority, the supreme law of the land is the key of our dual system of government, as the sovereignty of Parliament is the key of the British Constitution. But the Federal government, though supreme within the limits prescribed, is not omnipotent; it must keep within those limits. By the 10th amendment, passed immediately after the adoption of the Constitution, to prevent Congress from meddling with the domestic concerns of the States, or exercising powers not granted to them, it was expressly provided that the powers not delegated to the United States by the Constitution, nor prohibited by it to the States, are reserved to the States respectively, or to the people.

Thus the people of the United States created for themselves two separate and distinct governments, each of the people, by the people, and for the people. The federal government, independent and exclusive of the other within its own scope and sphere, and each able, without aid from the other, to reach for its own purposes, by its own authority, every person and every foot of land within its territory, and to keep as it sees fit, or to live under other forms of government, this dual system has worked very simply, smoothly, and harmoniously from the beginning until now, except for the single occasion when the terrible question of slavery proved to be too much for all the departments of government combined, and could only be settled by our long years of Civil War. But how has this marvelous result been accomplished? How has it been possible for these two governments, each of prescribed and limited powers, and each department of both similarly defined, to act independently and at the same time harmoniously over the same people? By what magical force has each power, State and Federal, been kept within its own limits? What has prevented constant and hopeless conflict between State functions and officials, and Federal functions and officials, between State and Nation, and between State and State, originally 13 in number and now 48? How has it been possible to secure the due protection of the law to the citizens of one State in each of the other States, and the rights of aliens against a State, to make treaties in any State, and how has the faith of treaties been preserved in every locality? These, and a thousand other similar questions and doubts as to the successful working of our system, are answered by pointing to the Supreme Court created by the Constitution, and to the Federal courts inferior to it created by Congress, in which the judicial power of the United States is vested, a power which, as has been said, is co-ordinate and co-extensive with the executive and legislative. Over whatever region Congress may attempt to legislate or the President to execute its laws, there the judicial power extends, to pass, if need be, upon the legality of their acts and the validity of their laws. The Constitution, and each of its provisions, is supreme over President, Congress, Courts and States, and the valid laws of Congress, and treaties made under the authority of the United States, are the supreme law of the land for all its people, and for the courts, legislatures, and governors of each State. The Supreme Court is the final judge of the validity of all laws passed by Congress or by the legislatures of each of the 48 States, when brought to the test of the Constitution of the United States, and of the governors or State. The Supreme Court brings to the same test. It and the Federal courts inferior to it furnish the vehicle by which the judicial power of the United States is carried into the whole of its vast territory, to administer justice within the limits prescribed to it, to enforce the Federal laws and to punish offenders against them.

The third article of the Constitution is marvelously brief and simple. The judges, according to that good old rule which has worked so well in England since the days of William and Mary, are to hold their offices during good behavior, and can only be removed by impeachment, and their compensation shall not be diminished during their continuance in office. The Supreme Court has original jurisdiction only in cases arising under the Constitution, and laws,ta their enforcement, and in cases of bills of attainder and ex Künt ins, and in those in which a State shall be a party. The first branch of this original power has seldom been invoked, but over and over again a great State has been brought to its test, to peace, and to boundary disputes, always the most dangerous
to the peace of adjoining States, and in each instance its decree has been submitted to with implicit obedience—a most unique judicial power, and a most convincing example to persuaded persons to settle controversies with each other at the highest level ever attained in the progress of representative government.  

Toqueville says: "In the nations of Europe the courts of justice are only called upon to try the controversies of private individuals, but the Supreme Court of the United States summons sovereign powers to its bar." John Stuart Mill declares it to be "the first example of what is now one of the most prominent wants of civilized society, a real international tribunal." In all other matters the jurisdiction of the United States exists only apppellate. The judicial power extends only to cases as they arise between party and party, and in the Supreme Court as they come to it mostly by appeal from the inferior Federal courts, or by writ of error to the State courts. The courts of the United States exercise no supervision over, or interference with the President or Congress, or the legislatures of the States. They have no veto power. They do not act in wait for acts of Congress, to strangle them at their birth. They have no jurisdiction to pronounce any statute, either of a State or of the United States, void because irreconcilable with the Constitution, except as they are called upon to adjudge the legal rights of litigants in actual controversies. They simply pass upon the rights of parties as they come before them, and if a provision of the Constitution, or of a Federal statute, or a treaty is invoked for or against a right claimed or denied, they interpret the Constitution, the law, or the treaty, and determine the right. In this way, and in this way only if an act of Congress or of a State legislature is claimed to be invalid, or an official act is claimed to be illegal under the Constitution of the United States, and the decision of that question is vital and necessary to determine the jurisdictionary duty of interpretation, and declare the validity or invalidity of the act, and so determine the right between the parties before them in that particular case, and for no other purpose, and this may happen months or years after the enactment of the statute.

The Supreme Court performs no duties except judicial duties. So, when in 1794 President Washington requested the opinions of the judges on the construction of the treaty with France of 1788, they declined to comply, and when an early Congress enacted that certain pension claims should be considered and passed upon by the Federal courts, the Supreme Court upheld them in refusing to act under it, upon the ground that the power proposed to be conferred was not judicial power within the meaning of the Constitution. Nor will the court give a hearing to a fictitious or collusive case, contrived to raise a question as to the validity of a statute, or in any way with the intent prescribed to it of exercising judicial power. The Federal judiciary has steadily refrained from exercising any political power, which belongs exclusively to Congress and the President, and so it has been brought into no collision with the other departments. It will not even indulge in discussions, or express opinions upon purely political questions, lest perhaps to induce it to interfere either to restrain or compel the President in the exercise of his power to see that the laws are faithfully executed have failed. In the case of foreign nations, as well as in that of the sovereign States of the Union, the government acknowledged by the President, or by the President and Congress, is always recognized by the Supreme Court. In all such questions as are purely political it holds itself bound by the acts of the other departments. So the question whether and upon what conditions aliens shall be excluded from the United States, belonging to the political departments of the government, the court refused to express any opinion upon the constitutionality of the measures enacted by Congress in the exercise of the powers confided to it by the Constitution over that subject. Thus it constantly sets the example to each of the other departments of the government of minding its own business, and keeping strictly within its assigned province. But, careful as the judges are to confine the exercise of the Federal judicial power to cases as they arise, that power does extend to "all cases of law and equity arising under the Constitution, the laws of the United States, and treaties made under their authority," to all cases affecting ambassadors, other public ministers and consuls, and to all cases of admiralty and maritime jurisdiction; and whenever any such case does come before the Supreme Court it must take cognizance of it, and it cannot shrink, and never has shrunk, from determining the question of private right so arising. It is under these clauses that its unique and peculiar function of testing the validity of State laws and constitutions and of Federal statutes, and the legality of the acts of State and Federal officers arises.

The remainder of the Federal judicial power depends wholly upon the character of the parties to the controversy. It extends to controversies between which the United States is a party. This enables the Federal courts to enforce the acts of Congress, civil and criminal, against all persons within the realm; to controversies between two or more States, the purpose of which has already been indicated, as making the Supreme Court the arbitrator and peacemaker between sovereign States; to controversies between a State and citizens of another State, between citizens of different States, between citizens of the same State, in cases arising under grants of different States, and between a State, or the citizens thereof, and foreign States, citizens, or subjects. It was wisely concluded that in all such cases justice would be safer and surer, against State or local interest, prejudice or passion, in courts representing and vested with the authority of the whole nation, than in the courts of the State of an interested party, and that foreigners especially should have the right to have their causes heard and decided by national tribunals. These clauses, which make jurisdiction dependent upon the character of the parties, have been a prolific source of litigation in the Federal courts, have
opened to them the entire field of law and equity; have extended their adjudications to the whole body of jurisprudence, and have given to the decisions of the Supreme Court, by reason of the weight and force of character of the court and its members, a commanding authority with the States in general, and the particular institutions with foreign tribunals. But in this department of its functions the Supreme Court does not differ, in the scope of its powers and duties, from the courts of last resort of other nations, and its distinctive and peculiar character is not involved. The power of the court to declare State and Federal statutes, and the acts of the National and State executive officers invalid, as being in violation of the Constitution of the United States, naturally attracts the attention of foreign observers.

In the 130 years of its existence the court has pronounced 33 acts of Congress, and more than 225 State statutes, to be in conflict with the Federal Constitution, and therefore invalid, and in each instance there has been complete and final decision. This is not that instead of being a disturbing element, the exercise of this power confirms the peaceful relation between the States and the Nation, and between the States as among themselves, protects foreign nations from the breach of treaties, and conserves the rights of property and contract, and the fundamental rights of personal liberty. The Constitution provides that "no State shall pass any law impairing the obligation of contracts," and the aid of the court has often been invoked for protection against the attempts of States to violate this prohibition. The framers of the Constitution believed, and the people of the United States, in view of the successful operation of this prohibition for more than a century, believe that the States ought not to be permitted to intervene between the parties to a contract, to destroy or impair the binding force of terms by which they have agreed to be bound, and that such intervention is contrary to the principles of popular government, that in the days that tried men's souls before the adoption of the Federal Constitution many attempts had been made by States to intervene for this purpose, which doubtless led to the adoption of this clause.

Mr. Hamilton, in the Federalist classing such laws asillops, and ex post facto laws, which are prohibited by the same clause, says:

"Laws impairing the obligation of contracts are contrary to the first principles of the social compact, and to every principle of sound legislation. They are prohibited by the spirit and scope of the State constitutions. Our own experience has taught us, nevertheless, that additional fences against such dangers ought not to be neglected. Very properly, therefore, have the Convention added this constitutional provision for the security of personal liberty and private rights. And I am much deceived if they have not, in so doing, as faithfully consulted the genuine sentiments as the undoubted interests of their constituents. The sober people of America are wary of the fluctuating policy which has directed the public councils. They have seen with regret and indignation that sudden changes and legislative interferences in cases affecting personal rights, become jobs in the hands of enterprising speculators, and spoils to the more ambitious and less informed part of the community. They have seen, too, that one legislative interference is but the first link in a long chain of further interferences, every subsequent interference not being naturally produced by the effects of the preceding. They even believe, therefore, that some thorough reforming and winding which will banish speculations on public measures, inspire a general prudence and industry, and give a regular course to the business of society."

In the celebrated Dartmouth College case the protection of this clause was invoked by the trustees of the college, to recover its property from a person who held it for new trustees under the authority of a law of the State of New Hampshire. In 1769, King George III by a royal charter of privilege incorporated the college named "The Trustees of Dartmouth College," granting to them and their successors the usual corporate privileges and powers, and authorizing the trustees who were to govern the college to fill up all vacancies which may be created in their own bodies. The appointment by the founder, who had already established the college, was for a charter to incorporate a religious and literary institution, and stated that large contributions had been made for the object, which would be conferred upon the corporation as soon as it was created, and on the faith of the charter the property was conveyed to it. After the Revolution (in 1816), the legislature of New Hampshire passed an act increasing the number of trustees to 21, giving the legislature the additional power of control over the governor of the State, and creating a board of overseers with power to inspect and control the most important acts of the trustees. Admitting that the provision of the Constitution embraced only contracts which respect property or some object of value, and which confer rights which may be asserted in a court of justice, and did not refer to grants of political power or to acts creating institutions to be employed in the administration of government or of public property, or in which the State as a government was alone interested, and the court mature consideration reached the conclusion, that the charter was a contract which secured to the trustees the property and control of the college—a contract made upon valuable consideration—for the security and disposition of property, and on the faith of which real and personal property had been conveyed to the institution, and, therefore, a contract, the obligation of which could be impaired without a violation of the Constitution of the United States. It held that the statute of New Hampshire did impair it, and rendered judgment restoring the property and control of the college to the trustees who represented the founder. The opinions of Chief Justice Marshall and Judge Story are masterpieces of judicial reasoning, and the principles laid down by them have ever since prevailed. In 56 cases decided by the court, acts of State legislatures have been declared invalid in accordance with these principles, because they impaired the obligation of contracts, and it is not too much to say that, instead of having a disturbing or disintegrating effect upon civil society, these decisions have done more than any other single cause to inculcate a reverence for the law, and for the sanctity of the right of private property, which is one of the chief objects of free government.

It is true that the constitutional prohibition against laws impairing the obligation of contracts does not expressly apply to Congress. In the convention, Mr. Gerry, a prominent delegate from Massachusetts, made a motion that Congress ought to be laid under the like pro-
hibitation, but found no seconder. But in the amendments which were proposed by Congress at its first session, almost as conditions on which many of the States had adopted it and which were quietly ratified, other restraints were laid upon Congress which had the like effect. It was expressly declared that no person shall be deprived of life, liberty or property without due process of law, nor shall private property be taken for public use without just compensation. No matter what the emergency, it cannot violate these fundamental principles of personal rights. The court has held that the United States cannot, any more than a State, interfere with private rights except for legitimate governmental purposes, that they are as much bound by their contracts as are individuals, that if they repudiate their obligations it is as much repudiation, with all the wrong and reproach that term implies, as it would be if the repudiator had been a State, a municipality or a citizen. But strict and earnest as the court has been in enforcing its constitutional prohibition against laws impairing the obligation of contracts, it has been remiss in recognizing and giving full force and effect to the statutes of other nations which imposed no such prohibition on the law-making power.

The Canada Southern Railway Company, under its charter granted by the Dominion of Canada, had issued its bonds at a high rate of interest, and had sold them in New York to citizens of the United States, but getting into difficulties the company devised a scheme of arrangement, which was enacted by the Dominion Parliament, by which the interest on the bonds outstanding was scaled down to a lower rate without the consent of the bondholders, a clear case of impairing the obligation of a contract. The bondholders appealed to the Supreme Court, which held that the arrangement Act was valid in Canada, and bound non-asserting bondholders there by force of the scheme; that as it did have that effect in Canada, the courts of the United States should give it the same effect, even as against citizens of the United States whose rights accrued in the United States before its passage; that there was no constitutional prohibition in Canada against the passing of laws impairing the obligation of contracts, and that, under these circumstances, the true spirit of international comity required that schemes of this character, legalized at home, should be recognized in other countries.

The clause of the Constitution giving Congress the power to regulate commerce with foreign nations and between the States, has been another fruitful source of business in the Supreme Court in the way of testing the validity of State laws. At the outset of steam navigation, the State of New York undertook to reward Robert Fulton for his invention and enterprise by an act giving him the monopoly of navigating by fire or steam all the waters within the jurisdiction of the State. Under this act the assignee of Fulton had commenced running a line of boats between certain ports of New York and New Jersey. Obtaining from the State courts of New York an injunction to restrain the owners of an opposition line of boats, put on between the same ports, from entering the waters of New York State with their boats. But the Supreme Court held, upon appeal, that the New York enactment was a conflict with the power of Congress to regulate commerce, and with its acts in respect to commerce, and upon this ground vacated the injunction and established the right of all vessels to enter the port of New York under the authority of Congress. It was held that by virtue of the clause referring to Congress had exclusive authority to regulate commerce in all its forms in all the navigable waters of the United States, their bays, rivers and harbors, and to make navigation free to all without and restraint or interference from any State legislature. By a long series of decisions that followed under the commerce clause the court, with inflexible firmness and far-reaching sagacity, established the absolute supremacy of the nation over the whole subject of commerce, navigation, travel and intercourse between the States, which went far to strengthen the power of the Union. At the same time they secured to the citizens of every State the full enjoyment of the privileges and immunities of citizens in all the other States, and also that absolute freedom of internal trade throughout the country which has so vastly promoted the prosperity of the people.

The influence of the court in maintaining the faith of treaties has been powerful and far reaching. By the treaty of peace with Great Britain, in 1783, it was agreed that British creditors should meet with no lawful impediments in the collection of their claims; and the Constitution said that treaties, like laws, made under its authority, should be the supreme law of the land. Various attempts had been made by several States, before the adoption of the Constitution, to impede or prevent the collection of such claims. The subject provoked bitter and exciting controversies, but the court, against the contention of John Marshall himself, then at the bar, held that the treaty was supreme, and equal in its effect to the Constitution itself, in overruling all State laws upon the subject, and that its words were as strong as the will of man could devise to override all obstacles directed against the recovery of such debts. Of course, any such law passed by a State after the treaty contrary to its terms would be void.

Perhaps the most striking illustration of the power of the court to declare acts of Congress itself invalid, as contrary to the Constitution, was the celebrated Income Tax (q.v.) case. Congress in 1894 had passed a General Revenue Law, certain sections of which imposed an income tax upon incomes exceeding a certain amount named. This tax was levied indiscriminately upon all incomes alike, from whatever source derived, whether from the rents of real estate, the income of invested personal property or from earnings. But the Constitution had ordained that direct taxes should be apportioned among the several States according to the numbers of their respective populations, in contradistinction to duties, imposts and excises, which should be uniform throughout the United States. But the Act was rendered invalid by those who challenged the validity of the law, that taxes on rent, and taxes on
the income derived from invested personal property, were direct taxes within the meaning of the Constitution, and that instead of being levied uniformly, man for man, throughout the United States the relative proportion of wealth apportioned among the several States according to population. The difference was very considerable and substantial. The effect of the act, if sustained, would be to throw the principal burden of the tax upon a few large States, in which the relative proportion of wealth was in excess of the relative proportion of population, and to exempt the other States proportionally from their constitutional share of the tax. The opponents of the income tax also insisted that any such apportionment, which should arise from its being apportioned among the States according to population, was an inequality contemplated by the framers of the Constitution, and was intended to prevent an attack upon accumulated property by mere force of numbers. The court, against vehement and powerful opposition at the bar, and from a formidable minority of the members of the court itself, took this view, and declared the tax to have been laid unconstitutionally, so far as it affected income in personal property. And as the invalid portions constituted so large a proportion of the whole income tax levied by the act, that Congress could not be deemed to have intended to impose the rest without them, it further adjudged that all the tax provisions of the act, which constituted a single and entire scheme, must be held void. There were some popular protests against the decision, and direful prophecies that it would disable the nation in future emergencies from raising the revenue needed, but no such results have yet appeared. Congress, in its subsequent enactments, has conformed to the decision, and when the war with Spain came on, and an immensely enlarged revenue was needed at once, it found no difficulty in imposing taxes constitutionally and so successfully that, the year after the war closed, the Treasury was found to be burdened with so great a surplus that the entire body of war taxes had to be repealed at once. The same case contains a fine example of the power of the court to protect the States in the exercise of their legitimate power to manage their own affairs from interference by the Federal government. The income tax was levied also upon income derived from the interest upon bonds issued by municipal corporations, which were but civil divisions of the States, and the court held that as a tax upon the income of municipal bonds tended to cripple the power of the local authorities to raise money for the purposes of local government, it was not within the power of the Federal government to impose it, any more than it would be constitutional for the States to impair the power of the Federal government to raise money for Federal purposes by taxing its bonds.

By the adoption of the 14th Amendment (g.v.), to meet the conditions resulting from the abolition of slavery at the close of the Civil War, new restraints were imposed upon the States, the consideration of which has largely occupied the attention of the Supreme Court. It provides that "No State shall make or en-
the domain of the other without danger, and that the safety of our institutions depends in no small degree on a strict observance of this salutary rule. It speaks volumes for the wisdom and caution of the court which is vested with this remarkable power, that in so great a mass of State legislation, some of it crude and undigested, consisting of thousands of volumes, it has not found it necessary to exercise the power much more frequently. It has been thought by foreign observers that a written Constitution, which was framed in the 18th century for 13 feeble States, with 3,000,000 of people of substantially uniform wealth or poverty, scattered along the Atlantic seaboard, and for whose government it was regarded as a precarious experiment, should be found to answer as well in the 20th century for the needs of a great nation of 80,000,000 in 48 States, occupying the breadth of the continent, with gigantic accumulations of individual and corporate property, with conflicting interests and sentiments, and wide differences of social condition. There was much debate in the discussions which resulted in the adoption of the Constitution, whether this instrument could be called into being could reach and control even a people that was expected to occupy the territory which the Treaty of Peace of 1783 secured to the United States, which extended only from the Atlantic to the Mississippi River, and from the lakes to the northern boundary of Florida. Since that time our territory has expanded more than four times, and now embraces insular possessions of vast extent, at enormous distance from the seat of government and half way round the globe.

The fundamental difficulties of time and space have been overcome by the triumphs of steam and electricity, wholly unforeseen and unexpected in 1787, but which now, in the case of the United States and Great Britain alike, have rendered possible the administration of government from London or from Washington on any portion of the earth’s surface. At the time of the adoption of our Constitution it took about 10 weeks to travel the length or breadth of the then United States as it does now to go from New York to Manila, or from London to Peking, and orders of either government which then would have taken months to transmit, now reach their destination so as to be put in execution at the other end of the world in a few hours, and sometimes in a few minutes. But in our case, we can account for the fact that a written Constitution, instead of being torn asunder and left by the way as the nation expanded, as new and wholly unexpected conditions arose, has grown with the growth of the nation, like the hide of an animal from its birth to its maturity, so that it still embraces and covers the whole of our vast national life. We owe it, first, to the wisdom of its framers, who inserted in it only fundamental rules and principles, generally and briefly expressed, leaving it always to Congress to fill in and provide for all the details; and secondly, to the vigorous and masterly manner in which the Supreme Court has exercised its essential and lawful function of construction. By this it has applied the whole instrument and each of its parts to new conditions as they arose, and has developed and strongly asserted the inherent powers of sovereignty intended to be vested in the government of the United States, and necessarily resulting from their existence as a nation. It was our happy fortune that for 34 years, in that critical period of our history when we were to determine whether we were to be a great and powerful nation, adequate for all the needs of a first-class power in the world, or only a league of States like the old Confederation, we had the benefit of the broad and robust intellect of Chief Justice Marshall, to enforce the liberal principles of the Constitution, which the genius of Hamilton had laid down.

In a single paragraph he states the whole theory upon which the court has administered the Constitution, and fitted it to the growing wants and changing conditions of the nation:

*The Government is acknowledged by all to be one of enumerated powers. The principle that it can exercise only the powers granted to it is now universally admitted. But the question respecting the extent of the powers actually granted is perpetually going on, and will probably continue to arise, as long as our system shall exist. The powers of the government are limited, and its powers as conceived. But the sound construction of the Constitution must allow to the National Legislature that discretion with respect to the means by which the powers which are expressly vested in it are to be carried into execution, which will enable that body to perform the high duties assigned to it in a proper and efficient manner. Let the end be legitimate, let it be within the scope of the Constitution, and all means which are appropriate, which are plainly admissible to that end, and which are not prohibited, but are consistent with the letter and spirit of the Constitution, are constitutional.*

Hamilton, in the *Federalist*, declared that the judiciary is beyond comparison the weakest of the three departments of power: that it can never attack with success either of the other two; and that all possible care is requisite to enable it to defend itself against their attacks. Montesquieu, whose works, with Blackstone’s, were the textbooks of constitutional liberty which the framers had constantly in hand, declared that the judicial power is next to nothing. And it was said by another French publicist, *It has no guards, palaces or treasures, no arms but truth and wisdom, and no splendid but the justice and publicity of its judgments.* But the Supreme Court, sustained generally by the confidence and affection of the people, has more than held its own. Keeping carefully within its own limits, it has for the most part labored to keep the other departments of government within theirs, and the powers of the States and of the nation from coming into conflict. In its hands the judicial power has been the force of gravitation which has kept each member of our Federal system in its proper orbit, and maintained the essential harmony of the whole.

The closing scene in the Federal Convention, which made the court in a way the guardian of the Constitution, will be ever memorable. After months of discussion, sometimes violent, more than once approaching the very brink of dissolution, in hopeless despair of coming to any agreement, at last the grand triumph of compromise and mutual concession was accomplished, and the members met to affix their names to the instrument. Hamilton, one of the youngest, acted as scribe, and after Washington had signed first as “President and Deput from Virginia,” inscribed on the great sheet of parchment the name of each State, as the delegates came forward in geographical order to add their names. When all had signed, Frank-
SURLAYA. — SURETYSHIP

lin, the oldest and most famous of them all, pointing to the sun emblazoned behind the chair in which Washington had presided through the whole struggle, said to those about him, "In the vicissitudes of Hope and Fear, I was not able to tell whether it was rising or setting."

After more than a century's trial of their work, the sun which Franklin saw is not yet near the zenith — much has been done, but vastly more remains to be accomplished, and it is still morning in the province of Surahaba.


JOSEPH H. CROATE.

SURABAYA, soo-râ-bâ (Dutch, Soerba-

vaja), Java, (1) the seaport and capital of the province of the same name on the north-east coast of the island of Java. The city is situated on the Strait of Surabaya, which separates Madura Island from Java. It is, next to Batavia, the most important port and commercial station in the Dutch East Indies, and has machine-stores, an arsenal, a mint, sugar and furniture factories, shipbuilding yards and foundries. It exports sugar, coffee and the various products of the region. Pop. about 150,000 including about 10,000 Europeans. (2) The province of Surabaya has an area of 2,327 square miles and a population of over 2,115,000.

SURAJAH Dowlah, soo-râ-jâ dowlâ, the last independent nabob of Bengal, under whom was perpetrated the massacre of the Black Hole (q.v.). He succeeded his grandfather, Ali Verdy Khan, in 1756, and within two months of his accession found a pretext for marching on Calcutta. On the arrival of Clive and Admiral Waterton he retreated to Moorsheadabad, but was routed at the battle of Plassey (1757). He then fled to the Ganges, but was betrayed by a fakir, and was put to death by order of the son of Meer Jaffer, the new nabob. Surajah Dowlah's reign lasted 15 months, his age at the time of his death being barely 20.

SURJAKARTA, soo-râ-kâr'tâ, a town in central Java, connected by rail with Samarang on the north and Surabaya on the east. It is the residence of the native sultan of Surakarta, who is a vassal of the Dutch government and is advised by a resident. The town (pop. 125,000) is the capital of his kingdom, a mountainous but in part very fertile region, with an area of 2,191 square miles and a population of about 1,100,000.

SURAT, soo-rât', India, a city in the Guj-

arat division of Bombay, extends for some distance in crescent form along the south bank of river Tapti, (an iron bridge) in a fertile valley. It is 160 miles by rail north of Bombay. The Nawab's palace lies within the confines of the fort. The remarkable buildings are four handsome Mohammedan mosques, two Parsi fire-temples, several Hindu temples, and a clock-tower (80 feet high). There is also an extensive bazaar, and a Hindu hospital for sick animals. The city in 1512 was burned by the Portuguese, again in 1530 and 1531. The English established themselves there in 1612, and the city came under British rule in 1800. Industry is limited to the manufacturing of cotton and silk goods, shawls, etc., articles of ornamentation, jewelry and ivory objects, indigo and pottery. The exports are cotton and grain. The commercial importance of Surat was established in the 16th century, and it was the starting point for pilgrimages to Mecca. Its decline dates from the removal of the East Indian Company to Bombay. Fire and flood contributed subsequently to its decadence. It flourished during the American Civil War through its cotton export. Pop. about 155,000.

SUREOUF, sûr-kouf, Robert, French naval officer: b. 1773; d. 1827. Much of his life at sea was devoted to privateering and he was known as 'the king of the Corsairs.' From 1798 to 1801 and from 1809 to 1811, he scourred the sea for English merchantmen as Paul Jones did some years previously. He divided between building French ships on shore and scouring the high seas for English merchant vessels. It was his advice to Napoleon: 'Attack rich England in her riches — in her merchant vessels; leave personal chivalry to the line at home and send out light privateers.'

SURETY. See SURETYSHIP.

SURETYSHIP, a word derived from the French sûreté, from the Latin securitas, which means freedom from care. It signifies the obligation of a person to answer for the debt, default or non-performance of another, and to make good any loss occasioned thereby to the extent provided in the contract. The difference between suretyship and guarantee is an essential one, a contract of suretyship being a direct liability to the creditor for the act to be performed by the debtor, whereas a guarantee is liability only for the debtor's ability to perform this act. A contract of suretyship is an immediate and direct undertaking that the act shall be done, and if the act is not done, the surety becomes responsible at once.

The Constitution of the United States makes it impossible for a State to enforce a law which might be construed as impairing the rights of a creditor under a contract of suretyship, but like other contracts it may be vitiated and annulled through fraud or duress in the execution. The surety is entitled to such information both from creditor and debtor as will enable him to know the nature of the obligation which he is assuming, and if there is fraudulent misrepresentation or suppression of the fact with the purpose of obtaining his agreement to the undertaking the surety can obtain relief in a court of equity. On the other hand his relief would not be granted against innocent parties who had, without notice from the surety, incurred expenditure or assumed obligations on account of the existence of the suretyship contract. Of course in such a case the surety would have a right to redress from the creditor or debtor, or both, who had caused him loss by deceiving him.

It should be understood that there is no obligation on the part of the creditor or of the
SURF-BIRD — SURFACE TENSION
debtor to disclose all facts relating to the risk,
but only those the withholding of which, if
known to them, or either of them, would con-
stitute intent to mislead. The surety, on the
other hand, is expected to use reasonable judg-
ment and precaution in making the contract.
The presumption of law is that the suretyship,
the surety’s signature being admitted, is valid,
and upon him rests the onus of attacking its
validity, if he so desires.

The surety’s responsibility cannot be changed
or made contingent, in any manner without his
consent, and should any change be
made in the contract without such consent, the
surety is discharged from his obligation. It
does not matter whether the change would be
advantageous to the surety or otherwise; he has
a right to stand upon the original terms,
and cannot be held responsible for any different
terms. This applies also to any extension of
the term of credit specified in the contract
without the surety’s approval in legal form.

Upon the discharge of his obligation by the
debtor, the surety is of course released. The
surety is likewise released by tender of pay-
ment by the debtor and refusal to receive it by
the creditor. In some States the surety is
released if the creditor does not sue the prin-
cipal of the surety. Should the
debtor default and the surety have to pay,
the surety becomes entitled to all the rights and
securities previously held by the creditor
against the debtor. If there are several sure-
ties, and the creditor’s claim is enforced against
one only, the latter can compel his co-sureties
to pay their several shares, and he also has a
claim against the principal for the amount
which he has expended in meeting the obligation.
See GUARANTEE.

SURF-BIRD, a shore-bird (Aphissa vir-
gates), in some districts of its own be-
tween the sandpipers and plovers. It is about
10 inches long, with the wing seven, dark
brown above, lighter on the wing coverts, with
white spots and stripes on the head and neck;
upper tail-coverts and a central pair of tail
feathers are white, the latter terminated with brownish black; un-
der parts white, tinged with ash in front, each feather having a brownish black crescent. The bill is about as long as the head, with a short, ovate, rather compressed sides; wings long and pointed. It is found on the Pacific Coast of North and South America, and in the Sand-
wich Islands, migrating from northern to tem-
perate regions in winter and back again in summer. It is generally seen on the edge of
steep rocks, among the retreating waves, search-
ing for small mollusks and marine animals, allowing the surf sometimes to dash over it,
whence the common name; its flight is short,
with a quick and jerking motion.

SURF-CLAM. See CLAM.

SURF DUCK, or SURF SCOTER. See Scot-
er.

SURF-FISH, one of the many small ovoid
fish of the family Embididae, related to the
percoids, which abound upon the Pacific
Coast of North America, where they are found
numerously in the surf on sandy beaches, and
in the mouths of rivers. They are often gayly
colored, sometimes in extraordinary patterns
of spots or bars; and are easily caught but not
valued much as food. The most familiar one
is Amphistium argenteus; several others are
commonly known as the blue, black, red and
white perchles, the alionoe, etc. All are vivipa-
rous.

SURF-SMELT, a small, eminently tooth-
some smelt (Hyphomemas pritcheri), numer-
ous along the coast of California and north-
ward, where it spawns in the surf, and is
caught in great quantities in nets. See Sme-
Rishes.

SURFACE, Joseph, a character in Sheri-
dan’s comedy, ‘The School for Scandal.’ He
is a mean hypocrite who affects great serious-
ness and sentimentality.

SURFACE. (1) A physical surface may be
defined as formed by the boundaries or limiting
portions of a given body. (2) A mathematical
surface is the boundary between two given por-
tions of space. It may be of various orders, a
plane surface being of the first order, a quadric
surface of the second order, etc. A surface
through all points of which a straight line may
be so drawn as to rest entirely within the said
surface, is termed a ruled surface. The cone,
cylinder and sphere are examples of this class.
A surface is said to be of the nth order when it
is intersected at n points, either imaginary or
real, by a given arbitrary line. For a treatment
of the subject, consult Eisenhart, L. P., ‘Treat-
ise on Differential Geometry, on Curves and
Surfaces’ (Boston 1909); Michaelis, M. L.,
‘Dynamics of Surfaces’ (New York 1914); Smith,
Charles, ‘Solid Geometry’ (3d ed., New
York 1891).

SURFACE TENSION, that property of
liquids in virtue of which they tend to take
such a form as to have the smallest surface
possible. The name ‘surface tension’ has refer-
ence to the fact that liquids, when freed
from the action of gravity and other compara-
tively powerful forces, behave as though their
surfaces were elastic membranes, which are
everywhere in a state of uniform tension. Be-
ginners in the study of physics often get the
idea, from their textbooks, that this hypotheti-
cal tension is real and that the surface of a
liquid really is membranous in nature, and sub-
ject to an actual, physical tension. This is not
at all the case; for the behavior of the liquid
is due to an entirely different cause, as will be
understood by reference to Fig. 1. AB here
represents a liquid surface, and m m m m m
represents a molecule of the liquid, which is
originally in the interior of the liquid, but
which is removed from it in the manner illus-
trated by the successive figures 1, 2, 3, 4 and 5.
Consider, first, the state of the molecule m in
the position 1. It is here surrounded by the
liquid on all sides, and the attractive influence
that the other molecules of the liquid exert
upon it is sensibly the same in all directions.
The circle that is drawn about m represents a
sphere whose radius is the *radius of sensible
molecular attraction*; that is, it is equal to the
(unknown) distance at which we may suppose
that the attraction of one molecule of the liquid
for another one ceases to be sensible. The at-
tractive influence of those parts of the liquid
which are external to this sphere being by
hypothesis insensible, we may regard m as in-
fluenced solely by such molecules as are within
a sphere of the radius shown. It is easily seen, therefore, that the attraction of the liquid for $m$ will be the same in all directions (and therefore without any resultant effect), so long as the sphere remains totally submerged. But when the molecule $m$ approaches the surface so nearly that a part of its sphere projects into the air as shown at 2, it is equally evident that the attractive force upon $m$ is no longer the same in all directions. In order to make it so, we should have to cut off, from the bottom of the sphere at 2, a segment equal to the segment that projects into the air, as indicated by the little shaded area. The mass of fluid that lies between this shaded segment and the surface of the liquid is without any resultant effect upon the phenomena that are manifested by liquid films, and by masses of liquid that are freed from the influence of gravity by being suspended in other liquids with which they will not mix, but which have the same density as the liquid to be studied. Olive oil can readily be freed from the action of gravity by submerging it in a mixture of alcohol and water, whose composition is regulated by trial until the mixture has precisely the same specific gravity as the oil. A mass of oil which is submerged in this manner, and is not constrained in any way, at once assumes a spherical form; for the sphere has a smaller surface than any other solid of the same volume.

The existence of surface tension can be shown readily and strikingly, even in a large mass of water, by several very simple experiments. Of these, the camphor-movement experiment is one of the best known. To perform it, a perfectly clean vessel is filled with clean water, some of the water being allowed to flow over the sides of the vessel, so that any superficial impurities may be washed away. Very fine and due to the fact that the surface tension of a solution of camphor in water is less than that of pure water. The camphor particles do not dissolve evenly on all sides; and the horizontal pull exerted upon them by the water is greatest in those directions in which the concentration of the solution in immediate contact with the particles is least. Hence the motions. The great importance of absolute cleanliness in this experiment is well illustrated by touching with a slightly greasy finger a water surface upon which camphor particles are in rapid motion. The entire surface becomes contaminated almost instantly, so that the camphor movements become deadened, or cease altogether.

The effects of surface tension are observable in large masses of liquid, where those masses come in contact with the walls of their containing vessels. The slight elevation of the water in a drinking glass, where the water touches the glass, is due to this cause. This particular phenomenon is more marked in the case of a glass tube of small diameter, dipping in a vertical position into a vessel of water (or any other liquid which actually wets the glass). Let the glass tube be inserted into the water, so that it is wetted up to a certain level, and let the tube be then raised slightly. The glass, in the region which has been submerged below the general level of the water and is now raised above it again, adheres to the water, and as the tube is raised, the column of water within it sinks at the centre, so that its surface becomes concave, as is illustrated in the diagram. The weight of that part of the water within the tube which stands above the general level of the water in the external vessel (that is, the weight of that portion which lies between the actual water surface in the tube and the dotted horizontal line), is sustained by the tension of the curved surface (or "meniscus") that bounds the column at the top; this tension acting everywhere in the direction of the surface of the water, and therefore having an obliquely-upward di-
resection around the edges, and hence a vertical component, which is capable of sustaining the water in the tube. In the case of a liquid which does not wet the tube (for example, in the case of mercury and glass), the curvature of the liquid surface is in the opposite direction from that observed with water and glass; that is, the meniscus is convex upwards, as shown in Fig. 3, and the liquid in the tube stands at a lower level than corresponds to the general level of the liquid surface in the containing vessel. In a barometer, the meniscus of the column is convex upward, and the depression of the column due to the surface tension of the mercury is usually quite sensible; so that in order to be in a position to know the exact height at which the mercury in the column would stand if the tube were large enough in diameter for the effects of surface tension to be negligible, it is necessary to investigate, very carefully, the way in which the depression varies with the diameter of the tube, and with the height of the meniscus itself. Numerous observers have made extensive investigations of this sort, and have given their results in tables. A very good table of this kind, due to Mendeleeff, is given in Guillaume’s ‘Thermométrie de Precision,’ and other tables will be found in nearly all of the works upon meteorology. The property of liquids in virtue of which they stand, in a vertical tube, at an elevation different from that in the vessel into which the tube is dipped, is commonly called ‘capillarity,’ reference to the small diameter of the tube in which the effect is most noticeable (Latin, capillus, ‘hair’).

Table of Surface Tensions at 20° C. (68° F.).

<table>
<thead>
<tr>
<th>LIQUID</th>
<th>Dynes per centimeter</th>
<th>Grams per centimeter</th>
<th>Grams per inch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>81</td>
<td>0.083</td>
<td>3.24</td>
</tr>
<tr>
<td>Mercury</td>
<td>540</td>
<td>0.551</td>
<td>21.58</td>
</tr>
<tr>
<td>Carbon disulphide</td>
<td>82.1</td>
<td>0.033</td>
<td>1.28</td>
</tr>
<tr>
<td>Chloroform</td>
<td>30.6</td>
<td>0.071</td>
<td>1.27</td>
</tr>
<tr>
<td>Alcohol</td>
<td>25.5</td>
<td>0.065</td>
<td>1.02</td>
</tr>
<tr>
<td>Olive oil</td>
<td>36.9</td>
<td>0.068</td>
<td>1.47</td>
</tr>
<tr>
<td>Turpentine</td>
<td>29.7</td>
<td>0.061</td>
<td>1.90</td>
</tr>
<tr>
<td>Petroleum</td>
<td>31.7</td>
<td>0.062</td>
<td>1.17</td>
</tr>
</tbody>
</table>

The surface tension of a liquid is measured by the horizontal pull that the liquid can exert upon a straight line one unit in length, lying in its surface; the pull being perpendicular, of course, to the direction of the line. The accompanying table contains the surface tensions of various liquids as determined by Quincke, and quoted by Maxwell. Mercury, for example, is capable of exerting a pull of 21.58 grains upon a straight line one inch long, lying in its surface. The value of the surface tension of water given in this table is certainly too great. Brunner found it to be 75.1 dynes per centimeter, and Wolf found 76.3 and 77.3. Rayleigh’s determination, based upon a study of the wave-length of ripples, gave 73.9 dynes at 18° C.; and T. Proctor Hall found that at 7° C. the surface tension of water, in the same units, is given by the expression.

$$75.14 - 0.1407.$$  

Bibliography.—Boys, ‘Soap Bubbles and How to Make Them’; Plateau, ‘Statique experimentale et théorique des liquides soumis aux seules forces moleculaires; Kisteen, ‘Molecules and the Molecular Theory of Matter.’ Also, any extended treatise on physics.

Allan D. Risteen.

SURFACES, Theory of. Surface, in the mathematical sense, is the common boundary of two contiguous regions of space. The developments in this vast field of mathematical investigation are essentially of modern origin. The geometers of the Greek school were acquainted with some of the elementary properties of a few surfaces, notably those of sphere, cylinder and cone, but the systematic and fruitful study of surfaces began with their representation by means of equations in Cartesian co-ordinates (see GEOMETRY, Cartesian). This was not done until the method of co-ordinates had been employed with success in the study of plane curves, whereupon its application to surfaces presented itself as a natural extension. According to Cantor, ‘Geschichte der Mathematik,’ Parent (1666-1716) was the first to represent surfaces analytically by means of a single equation $F(x, y, z) = 0$. To each set of values of $x, y, z$ satisfying this equation corresponds a point of the surface. With the introduction of co-ordinates two distinct phases in the study of surfaces present themselves. On the one hand the surface is defined in some purely geometric way, and the problem is to find an equation analytically representative of the surface. On the other hand an equation is assumed, and the problem is to arrive at the properties of the surface from its analytical definition. In the first case no less than in the second, the deduction of geometric properties proceeds, in the main, along analytical lines. It is at once evident that the second phase of the general problem greatly broadens the scope of investigation, and it is from this point of view that the mathematicians have studied the surfaces defined by algebraic equations of second, third, fourth, and higher degrees. The algebra brings in imaginary roots, and this leads to the introduction of surfaces that are altogether imaginary, and to the consideration of imaginary points and elements in connection with real surfaces.

In what has been said thus far the point has figured as the primitive element of the surface, and in connection with it the surface is a two-dimensional continuum of points. With the expansion of the subject additional primitive elements were introduced, and the plane and the line, and from the standpoint of the new elements the surface may be regarded as a
two-dimensional continuum of planes, i.e., as the envelope of its tangent planes, or as a three-dimensional continuum of lines, i.e., the envelope of its tangent lines. The theory of a surface as the envelope of its $w^2$ of tangent lines constitutes a special chapter in the general theory of complex of straight lines (see \textit{Geometry, Line, and Allied Theories}). Along with the analytical method, the synthetic or projective method has been employed, and with special elegance and completeness in the case of surfaces of the second order. With this brief introduction we now pass to a more detailed account of the developments in this branch of mathematics.

1. Algebraic Surfaces in General.—Any surface which can be analytically expressed by an algebraic equation between the Cartesian co-ordinates $x, y, z$ of a point of space is called an \textit{algebraic} surface. The \textit{order} of the surface is the number of points of intersection (real or imaginary) of the surface by an arbitrary straight line. The order of the surface is obviously the same as the degree of its equation. The \textit{class} is the number of tangent planes of the surface that pass through an arbitrary line. When there is no singularity (see 7) on the surface the class is $n(n-1)$. The \textit{rank} of the surface is the order of a circumscribing cone whose vertex is an arbitrary point of space. The rank is $n(n-1)$. The intersection of the surface by a plane is a curve of nth order, and, by the foregoing, the class of this curve is the same as the rank of the surface.

2. The Plane.—This is the simplest of all surfaces, and its equation in the variables $x, y, z$ is of the first degree: $Ax + By + Cz + D = 0$, in which $A, B, C, D$ are constants. It is the only surface of first order.

3. Surfaces of the Second Order, or Quadric Surfaces.—The earliest investigations were connected with the surfaces of the second order, namely, those defined by the general equation of the second degree: $Ax^2 + By^2 + Cz^2 + 2Fxy + 2Gyz + 2Hxz + 2Lx + 2My + 2Nz + P = 0$.

This equation contains 10 coefficients which enter homogeneously. However, only the nine ratios of the coefficients are essential, as the equation may be divided through by any coefficient that is not zero. From this fact comes an important theorem. The substitution of the co-ordinates of a given point in the general equation imposes one equation of condition upon the coefficients; nine such equations determine the ratios of the coefficients, and hence the equation, and with it the surface. The theorem follows: A surface of second order is in general determined by nine points through which it is to pass.

4. Classification of Quadric Surfaces.—There are in all 16 surfaces of the second order, when the purely imaginary and degenerate cases are included in the notation. The classes of the individual surfaces varies with the principle employed. The principle of division may be based on analytical criteria or on geometrical characteristics. Four different varieties of geometrical classification are known. In one the surfaces are divided into (a) the surfaces with centre or central surfaces, (b) the non-central surfaces. A second classification gives, (a) ruled surfaces with real generating lines (see 16), (b) non-ruled surfaces (analytically these latter surfaces are ruled surfaces with imaginary generating lines). A third classification rests upon the presence or absence of vertices on the surface. For example, a cone has a vertex and two intersecting planes are a degenerate form of a surface of second order with the line of intersection as a line of vertices. An ellipsoid is without a vertex. The fourth classification is based upon the nature of the cone that is cut from the surface by the plane at infinity.

We now present a classification based upon analytical criteria. This is effected by means of the values of two polynomials $d$ and $D$, functions of the coefficients, and of the roots $k = \lambda, \mu, \nu$, of a cubic equation in $k$ called the discriminating cubic. They may be conveniently put in the determinant form, as also the cubic equation:

$$
\begin{vmatrix}
A & H & G & L & D \\
H & B & F & M & H \\
G & F & C & N & G \\
L & M & N & P & L \\
D & H & G & L & A - k - H - G - L = 0
\end{vmatrix}
$$

I. Surfaces for which $D > 0$.

(a) $D > 0$, (i) Ellipsoid, real, if $\frac{D_1}{d}, \frac{D_2}{d}, \frac{D_3}{d}$ are all negative.

(ii) Hyperboloid of one sheet if two of the quantities are negative.

(iii) Hyperboloid of two sheets if one of the quantities is negative.

(iv) Ellipsoid, imaginary, if all the quantities are positive.

These are \textit{surfaces with centre}. By a suitable translation of the co-ordinate axes, by the centre the general equation can be thrown into the form $\lambda x^2 + \mu y^2 + \nu z^2 + d = 0$, in which $d = \frac{D}{D}$ and $\lambda, \mu, \nu$ are the roots of the discriminating cubic.

\begin{figure}[h]
\centering
\includegraphics[width=0.5\textwidth]{ellipsoid.png}
\caption{Ellipsoid.}
\end{figure}

(b) $D = 0$, (i) Elliptic paraboloid if $\lambda$ and $\mu$ have the same sign.

(ii) Hyperbolic paraboloid if $\lambda$ and $\mu$ have different signs.

When $D = 0$, one of the roots $\lambda, \mu, \nu$ is zero, and it is here assumed that $\nu = 0$. By a suitable transformation of the origin of co-ordinates to a point of the surface, the equation may be made to take the form $\lambda x^2 + \mu y^2 + 2\rho x = 0$.

The surfaces (a) and (b) are \textit{surfaces without vertices}. 

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II. Surfaces for which $d = 0$.

$(y) \quad D < 0$,

(i) Cone, real, if $\lambda$, $\mu$, $\nu$ are not all of same sign.

(ii) Cone, imaginary, if $\lambda$, $\mu$, $\nu$ are of same sign.

By taking the origin at the vertex of the cone the equation may be brought into the form $\lambda x^2 + \mu y^2 + \nu z^2 = 0$.

$(y) \quad D = 0$,

(i) Elliptic cylinder, if $\lambda$ and $\mu$ are of same sign and $d \geq 0$.

(ii) Hyperbolic cylinder, if $\lambda$ and $\mu$ are of different signs and $d \geq 0$.

(iii) A pair of intersecting planes, real or imaginary, if $d = 0$.

(iv) Parabolic cylinder; or two parallel planes, real or imaginary (if all the subdeterminants of $D$ are zero).

The ruled surfaces among quadric surfaces fall into two categories: (1) the cone and cylinder, each containing one set of generating lines infinite in number; (2) the hyperboloid of one sheet and the hyperbolic paraboloid, each containing two sets of generating lines infinite in number. On the two last-named surfaces no two lines of one set intersect, but each line of one set intersects all the lines of the other set.

5. Surfaces of the Third Order, or Cubic Surfaces.—A considerable number of theorems about these surfaces are now known, though their properties have by no means been so exhaustively studied as in the case of quadric surfaces. There are two especially distinguishing properties to be noted concerning them: first, on the general surface there are 27 right lines; second, there is related to the surface a pentaedron whose edges and vertices lie on the Hessian of the surface. When there is no singular point on the cubic surface its equation can be thrown into the form $c_1 W_1 + c_2 W_2 + c_3 W_3 + c_4 W_4 + c_5 W_5 = 0$, where $W_1, W_2, \ldots$ are linear in $x, y, z$ and the equation $W_1 + W_2 + W_3 + W_4 + W_5 = 0$ holds identically. The Hessian of the cubic is

$$
\frac{1}{c_1 W_1} + \frac{1}{c_2 W_2} + \frac{1}{c_3 W_3} + \frac{1}{c_4 W_4} + \frac{1}{c_5 W_5} = 0,
$$

a surface of fourth order. It contains the 10 edges and the 10 vertices of the pentaedron formed by the five planes $W_1 = 0, W_2 = 0, \ldots$. The vertices are double points (see VII) of the Hessian. For particulars as to these surfaces consult Salmon, 'Geometry of Three Dimensions,' and also Stürmer, 'Synthetische Untersuchungen über Flächen dritter Ordnung' (Leipzig 1857).

6. Surfaces of Fourth Order.—Of these only special surfaces have been thoroughly discussed, among them the ruled surfaces and the Kummer surface. The Kummer surface contains 16 double points and 16 singular planes. Each of the planes is tangent to the surface along a conic and contains six of the double points, and through each double point pass six of the singular planes. Consult Salmon-Friedler, Vol. II, and Kummer, 'Berliner Abhandlungen' (1866). The results obtained in the study of algebraic surfaces of order higher than the fourth are of more or less fragmentary character and need not be referred to in this brief sketch.

7. Ordinary and Singular Points.—In general the $n$ points of intersection of a line and surface are distinct, but if a point $P$ appears as $k$ coincident points among the $n$ intersections for every straight line through it, it is called a $k$ multiple point of the surface. When $k = 2$ it is a double point, when $k = 3$ a triple point. Multiple points are singular points. Through a double point on a surface an in-
finity of lines can be drawn each of which will pass through a third point on the surface infinitely near the double point. The locus of these lines is a cone of second order. There are three cases: (1) the cone is a proper cone and the double point is called a conical point; (2) the cone degenerates into two intersecting planes and the point is a biplanar point; (3) the cone degenerates into two coincident planes and the point is a uniplanar point or pinch point. There may be a curve of double points on a surface: for example, the curve of intersection of a surface by itself is such a locus, as is also the curve of contact of two sheets of the same surface with each other. For a detailed study of the character of a surface in the neighborhood of a double point consult Rohn, 'Mathematische Annalen, 22' (1883). As the study of a surface proceeds in general from the equation of the surface, it is to the analysis we must look for a definitive criterion distinguishing ordinary and singular points. A point \( s, t, x, y, z \) of a surface \( F(x, y, z) = 0 \) is said to be ordinary, if the \( F \) function is developable in an entire series in the neighborhood of \( x, y, z, \) and if the three first derivatives \( \partial F/\partial x, \partial F/\partial y, \partial F/\partial z \) do not simultaneously vanish at the point. All other points are singular points.

8. General Considerations. Curvilinear Co-ordinates.—Modern progress in the theory of surfaces begins with the appearance in 1827 of Gauss' paper, 'Disquisitiones generales circa superficies curvas' (translated into German in Ostwald's 'Klassiker der exakten Wissenschaften'; into English by Morehead and Hiltebeitel, Princeton). Two things in this classical production have profoundly affected subsequent developments in the theory. The first was the systematic employment of curvilinear co-ordinates, and therewith a demonstration of the great advantages which could be derived from their use; the second was the conception of a sury extension, not rigid but flexible, which could be made to assume new shapes by bending without stretching. All surfaces derived from a given surface by bending are said to be applicable, or developable, upon each other. It is clear that the geometry of figures on such surfaces is the same. The analytical criteria, whether two given surfaces are applicable upon each other, constitute one of the interesting chapters in the general theory. In expressing the Cartesian co-ordinates \( x, y, z \) as functions of two variables \( u, v \) called parameters:

(A) \( x = \phi(u, v), \ y = \psi(u, v), \ z = \gamma(u, v) \)

a new form of representation of surfaces is established. The elimination of \( u \) and \( v \) would obviously lead to one equation, \( F(x, y, z) = 0 \). If \( u \) be given a definite value \( u_0 \) and \( v \) be allowed to vary, a curve will be generated lying on the surface (see Curves of Double Curvature). The curve is called the \( u \) curve, that is, it is named by the special value of the parameter at all its points. Assigning a second value to \( u \), say \( u_1 \), and allowing \( v \) again to vary, there would be formed the \( u_1 \) curve of the surface. In this way there could be formed an \( \infty \) of curves on the surface constituting the family of \( u \) curves. Similarly, there is a family of \( v \) curves each characterized by a definite value of \( v \) while \( u \) is variable. Each point of the surface is the intersection of a \( u \) curve and a \( v \) curve, and the curves are called its curvilinear co-ordinates. One may thus speak of the point \( (u_0, v_0) \) of the surface, or in general of the point \( (x, y, z, u, v) \), in place of referring to it by its Cartesian co-ordinates. Both co-ordinate systems are put in evidence by writing the point in the form \( (x, y, z; u, v) \). A restriction upon the values \( u \) and \( v \) may take, such as an equation \( f(u, v) = 0 \), defines a curve on the surface.

9. Tangent Plane. Principal Normal Sections.—If to all the curves on a surface passing through an ordinary point \( P(\xi, \eta, \zeta; u, v) \), tangents be drawn at \( P \), the line will lie in a plane called the tangent plane at \( P \). Its equation is:

\[
\left( \frac{\partial x}{\partial u} dx + \frac{\partial x}{\partial v} dv \right) (\xi - x) + \left( \frac{\partial y}{\partial u} dx + \frac{\partial y}{\partial v} dv \right) (\eta - y) + \left( \frac{\partial z}{\partial u} dx + \frac{\partial z}{\partial v} dv \right) (\zeta - z) = 0.
\]

where \( \xi, \eta, \zeta \) are the current co-ordinates of the points of the plane.

The line perpendicular to the tangent plane at \( P \) is the normal of the surface at \( P \). Every plane through the normal is a normal plane, and the sections made by them with the surface are normal sections.

10. The Fundamental Quadratic Forms and the Fundamental Magnitudes of the First and Second Order. The Fundamental Equations.—The entire theory of a surface is implicitly involved in two fundamental quadratic differential forms, and in three fundamental differential equations. The first form is the expression for the square of the arc length \( ds \) on the surface between two infinitely near points \( P(x, y, z; u, v) \) and \( P_1(x + dx, y + dy, z + dz; u + du, v + dv) \). This is found to be:

\[
(\delta) \quad ds^2 = dx^2 + dy^2 + dz^2 = Edu^2 + Fdu dv + Gdv^2,
\]

where:

\[
E = \left( \frac{\partial x}{\partial u} \right)^2 + \left( \frac{\partial y}{\partial u} \right)^2 + \left( \frac{\partial z}{\partial u} \right)^2,
\]

\[
F = \left( \frac{\partial x}{\partial v} \right)^2 + \left( \frac{\partial y}{\partial v} \right)^2 + \left( \frac{\partial z}{\partial v} \right)^2,
\]

\[
G = \left( \frac{\partial x}{\partial u} \right)^2 + \left( \frac{\partial y}{\partial u} \right)^2 + \left( \frac{\partial z}{\partial u} \right)^2.
\]

The second quadratic differential form is the expression for twice the distance, \( d \), from the point \( P \) to the tangent plane at \( P \):

\[
(\delta) \quad 2d = |D| = \sqrt{EG - F^2},
\]

where:

\[
D = \begin{vmatrix}
\frac{\partial x}{\partial u} & \frac{\partial y}{\partial u} & \frac{\partial z}{\partial u} \\
\frac{\partial x}{\partial v} & \frac{\partial y}{\partial v} & \frac{\partial z}{\partial v} \\
\frac{\partial x}{\partial w} & \frac{\partial y}{\partial w} & \frac{\partial z}{\partial w}
\end{vmatrix}
\]

The six magnitudes \( E, F, G; D, D', D'' \) on account of their importance are called funda-
mental magnitudes: the first three as containing derivatives of the first order are called the fundamental magnitudes of the first order; the second three as containing derivatives of the second order are called the fundamental magnitudes of the second order. The six magnitudes are not independent of each other, but are connected by three partial differential equations called the fundamental equations of the surface. These may be obtained by differentiation from the foregoing equations. They are:

\[
\begin{align*}
DD'' &= \frac{D^3}{EG} \\
&= \frac{1}{2(EG - F^2)} \left[ \frac{\partial^2 E}{\partial u \partial v} + \frac{\partial E}{\partial v} \frac{\partial G}{\partial u} - 2 \frac{\partial G}{\partial u} \frac{\partial F}{\partial v} \right] \\
&\quad + \frac{4(EG - F^2)}{E} \left[ \frac{\partial^2 E}{\partial u^2} + \frac{\partial E}{\partial u} \frac{\partial G}{\partial u} - 2 \frac{\partial G}{\partial u} \frac{\partial F}{\partial u} \right] \\
&\quad + \frac{4(EG - F^2)}{G} \left[ \frac{\partial^2 E}{\partial v^2} + \frac{\partial E}{\partial v} \frac{\partial G}{\partial v} - 2 \frac{\partial G}{\partial v} \frac{\partial F}{\partial v} \right] \\
&\quad + \frac{4(EG - F^2)}{F} \left[ \frac{\partial^2 E}{\partial u \partial v} + \frac{\partial E}{\partial u} \frac{\partial G}{\partial v} - 2 \frac{\partial G}{\partial u} \frac{\partial F}{\partial v} \right] \\
&\quad - 2 \frac{\partial^2 E}{\partial u \partial v} + \frac{\partial^2 E}{\partial u^2} + \frac{\partial^2 E}{\partial v^2}.
\end{align*}
\]

\[
\begin{align*}
D'' &= \frac{D'}{du} \\
&= \frac{1}{2(EG - F^2)} \left[ D'' \left( \frac{\partial E}{\partial u} - \frac{\partial G}{\partial u} \right) + \frac{\partial^2 E}{\partial u^2} - 2 \frac{\partial G}{\partial u} \frac{\partial F}{\partial u} \right] \\
&\quad - D' \left( \frac{\partial E}{\partial u} - \frac{\partial G}{\partial u} \right) + 2 \frac{\partial E}{\partial u} \frac{\partial F}{\partial u} - 2 \frac{\partial F}{\partial u} \right) \\
&\quad + D'' \left( \frac{\partial E}{\partial F} - \frac{\partial G}{\partial F} \right) + \frac{\partial^2 E}{\partial u^2} - 2 \frac{\partial G}{\partial u} \frac{\partial F}{\partial u} \right) \right].
\end{align*}
\]

Equation (\(y\)) was established by Gaus in the paper previously cited. The first member of this equation, \((\frac{D''}{D'})^2\), has an interesting geometrical significance in connection with the curvature of the surface (see 12). Equations (d) and (e) were determined by Mainardi (1857) and 11 years later, independently, by Codazzi. The three equations are known as the Gauss-Mainardi or Gauss-Codazzi equations. It is evident that \(E, F, G\) satisfy the conditions: \(E > 0, \ G > 0, \ FG - F^2 > 0\). To Bonnet is due the theorem that a surface is completely determined in all respects, except only as to its position in space, by six given functions \(E, F, G, D, D', D''\) of two variables \(u, v\), provided that the six functions satisfy the three fundamental equations (1), (d), (e), and the three inequalities. The determination of the Cartesians variables \(x, y, z\) as functions of \(u, v\), depends upon the integration of a differential equation of the Riccati type (see Equations, Differential).

11. Curvature of Curves Traced upon the Surface Theorems of Mensnier and Euler. Principal Radii of Curvature. The problem of the curvature of curves traced on the surface through \(P\), and the relations of these curvatures, is simplified by considering first only those curves that have a common tangent at \(l\). Let the common tangent be \(PT\), and, for the sake of definiteness, let it be the tangent through \(P(u, v)\) and the infinitely near point \(l(u + du, v + dv)\). Conceive as drawn the sphere whose radius \(R\) and centre \(l\) are the radius of curvature and centre of curvature (relative to \(P\)) of the normal section with the tangent line \(PT\). *Mensnier's theorem states* that the plane of osculation of any curve through \(P\) with tangent line \(PT\) intersects the sphere in the circle of curvature of the curve relative to \(P\). If \(\tau\) is the angle between the plane of osculation of the curve and the normal section, and \(R\) the radius of curvature of the curve, then \(R = R \cos \tau\).

It remains to express the value of \(R\). *Newton's theorem concerning curvature of plane curves gives immediately*:

\[
\frac{1}{R} \frac{ds}{dr} = Edu^3 + 2Ddu dv + D''dv^3.
\]

To each value of \(\frac{dv}{du}\) correspond a tangent direction at \(P\) and a normal section, and the equation above determines the curvature of this section relative to \(P\). There are two values of \(\frac{dv}{du}\) for one of which \(R\) takes a maximum value, and for the other a minimum value. By the usual methods employed in maxima and minima the two values of \(\frac{dv}{du}\) are found to satisfy the equation:

\[
(FD'' - GD') \left(\frac{dv}{du}\right)^2 + (ED'' - GD) \frac{dv}{du} + PD = 0,
\]

and the two corresponding values of \(R\), viz., \(R_1\) and \(R_2\), the equation.

\[
(FD'' - GD')R^2 - (ED'' - 2FD + GD)R + EG - F = 0.
\]

The two tangent directions at \(P\) thus distinguished are at right angles to each other and are called the principal directions of curvature at \(P\), and the corresponding normal sections are the principal normal sections. \(R_1\) and \(R_2\) are called the principal radii of curvature of the surface at \(P\).

*Euler's theorem expresses the radius of curvature \(R\) of any normal section in terms of the principal radii of curvature and an angle \(\phi\). The equation is:

\[
\frac{1}{R} = \frac{1}{R_1} \cos^2 \phi + \frac{1}{R_2} \sin^2 \phi,
\]

where \(\phi\) is the angle between the normal section in question and the principal normal section corresponding to \(R_1\). In Euler's and Menger's theorem the theory of the curvature of curves traced on a surface finds a satisfactory exposition.

12. Curvature of the Surface. *Gauss Spherical Representation.—Various definitions of curvature of a surface have been suggested, of which three have found general acceptance. The three curvatures differ in kind. It is found that the mean value of the curvatures of all the normal sections through \(P\) (relative to \(P\)) is one-half the sum of the curvatures of the principal normal sections at \(P\), viz.,

\[
\frac{1}{2} \left( \frac{1}{R_1} + \frac{1}{R_2} \right).
\]

It would be natural to take this
value as the mean curvature of the surface at $P$, but the mathematical world has chosen to give the name mean curvature to the double of the quantity. Having regard to (9), one has

(4) Mean curvature at a point

$$k = \frac{1}{R_1 R_2} \left( \frac{ED'' - 2FD' + GD}{EG - F^2} \right).$$

The other two curvatures are connected with Gauss's method of representing a surface upon a sphere by means of parallel normals. At a point $P$ of the surface the positive normal is drawn; from the centre of the sphere a radius is drawn parallel to the normal; the extremity $p$ of this radius is called the spherical image or picture of $P$. When $P$ describes a curve on the surface, $p$ describes a curve on the sphere, and, in general, to an area on the surface corresponds an area on the sphere. Gauss has called the area on the sphere the total curvature (curvatura integra) of the corresponding area on the surface. If $\Delta s$ is an infinitely small area on the surface above the point $P$ and $\Delta s_1$ its total curvature, the ratio

$$\frac{\Delta s}{\Delta s_1}$$

is called the measure of curvature (curvatura specifica) or Gauss curvature of the surface at $P$. Gauss showed that this ratio is

$$\frac{1}{R_1 R_2},$$

whence the theorem, that the measure of curvature at a point is equal to the product of the principal curvatures of the surface at the point. Using $K$ to represent this curvature, and having regard to (9),

(5) Measures of curvature at a point

$$K = \frac{1}{R_1 R_2} \left( \frac{DD'' - DD'^2}{EE - F^2} \right).$$

13. Dupin's Indicatrix. Lines of Curvature, Asymptotic Lines. Conjugate Directions.—To ascertain the nature of the surface in the immediate neighborhood of a point $P$, one intersects the surface by a plane parallel to and infinitely near the tangent plane at $P$. The curve of section is called the indicatrix relative to $P$. The indicatrix is, in general, a conic whose equation is (6) when $d$ is constant. As $d$ is infinitely small of second order, the curve may be regarded as lying in the tangent plane at $P$ with $P$ as centre. Taking the tangents of the principal directions of curvature at $P$ as co-ordinate axes ($\xi_1$, $\xi_2$), equation (6) becomes

$$\frac{\xi_1^2}{\xi_1^2} + \frac{\xi_2^2}{\xi_2^2} = 1.$$

When $R_1$ and $R_2$ have like signs the indicatrix is an ellipse, and when the signs are unlike it is a hyperbola. In the first case $P$ is an elliptic point of the surface and the neighborhood of $P$ is convex-convex relative to the tangent plane; in the second case $P$ is a hyperbolic point and the neighborhood of $P$ is convex-concave. If either $R_1$ or $R_2$ is infinite at $P$, the indicatrix is two infinitely near parallel right lines. $P$ is then called a parabolic point. A surface may contain a region of elliptic points and a region of hyperbolic points. The curve separating the two regions is a locus of parabolic points. For a surface of parabolic points, $K$ must be identically zero (see 17).

By reference to the indicatrix at every point of the surface, one may define the system of lines of curvature as the two series of orthogonally intersecting curves ($\omega^1$ in each series) whose tangent directions coincide with the principal axes of the indicatrix, i.e., with the principal directions of curvature (see 11). From the definition it follows that ($\psi$ is the differential equation of the lines of curvature. The integration of ($\psi$) for any surface whose fundamental magnitudes are known furnishes the two series of lines of curvature of the surface. It is characteristic of a line of curvature that the normals of the surface at two consecutive points of the curve intersect, and this property is sometimes given as the definition of the curve. By reference to this property a ready means is occasionally afforded for identifying the lines of curvature; for example, on a surface of revolution one of the series of lines of curvature consists of the meridians and the other series of the parallel circles. The sphere and plane form a class apart from all other surfaces as regards lines of curvature, for any curve on either surface is a line of curvature. To Joachimsthal is due the theorem that, if two surfaces intersect in a constant angle and the curve of intersection is a line of curvature on the one, it is also a line of curvature on the other. It follows in particular that, if a plane or sphere intersects a surface in a constant angle, the curve of section is a line of curvature.

Again, by reference to the indicatrix, one defines the system of asymptotic lines as the two series of intersecting curves whose tangent directions coincide with the asymptotes of the indicatrix. Asymptotic lines are real only in the hyperbolic region of the surface. The differential equation of asymptotic curves is

$$2D'ds + 2D'ds_1 + 2D''ds_2 = 0.$$

It is characteristic of an asymptotic line that the plane of osculation at any point of it is the tangent plane of the surface at the point.

Two conjugate diameters of the indicatrix of a point give conjugate directions at the point; and reference to any direction there is a conjugate. A system of curves consisting of two series of intersecting curves is conjugate when the above condition is satisfied at every point of intersection. In partial illustration of the foregoing definitions it may be remarked that all the points of a hyperbola are hyperbolic, and that the right-line generators are its asymptotic lines. On the anchor-ring surface, i.e., the surface generated in rotating a circle about a line in its plane, the curves described by $A$ and $B$, the extremities of the diameter parallel to the axis of rotation, are curves of parabolic points; the inner surface of the ring is the region of hyperbolic points, the outer surface the region of elliptic points. The generating circle is in every position a line of curvature. It remains to define an umbilic as a point at which the indicatrix is a circle.

14. Isothermal Lines. Minimal Lines. Geodesic Lines.—Curvature — Circles — Co-ordinates.—If the $ds^2$ of a surface assumes the form

$$ds^2 = a(u, \psi) \left[ du^2 + dv^2 \right],$$

where $E = G = a(u, \psi) F = 0$, the parameter curves $u = \text{constant}$, $v = \text{constant}$, form an isothermal system (or isometric system) of curves. The parameters $u$ and $v$ are called thermal parameters. The distinguishing par-
erty of isothermal lines lies in this, that by their means the surface can be divided into a network of infinitely small squares. The division is effected by giving to \( u \) and \( v \) series of values in arithmetical progression, the curve series having the same common difference (\( du = dv \)). The squares differ, in general, in magnitude. There is an infinity of isothermal systems on a surface, for the characteristic form (\( \ell \)) is reproduced in new parameters \( u, v \), by making the substitutions
\[
\begin{align*}
u' + iv' &= f(u + iv), \\
u - iv &= f_1(u - iv),
\end{align*}
\]
where \( f \) and \( f_1 \) are conjugate functions but otherwise arbitrary.

It is noted that (\( \ell \)) may be thrown into the form
\[
ds^2 = a(u, v) [(du + iv) (du - i dv)]
\]
and, hence, by the substitutions \( u = u + iv, \mu = u - iv \), an equation of second order. From the theory of these equations (see Equations, DIFFERENTIAL) it follows, that an infinity of geodesics may be drawn at any point of a surface, each determined by its direction at the point.

The expression for \( ds^2 \) takes a notable form when the parameter lines, \( v = \text{constant} \), are geodesics and the parameter lines, \( u = \text{constant} \), are their orthogonal trajectories. Two cases are of interest:

1. The geodesic parallel system, in which the geodesics are drawn perpendicular to an arbitrary curve \( c \) as shown in Fig. 6, and \( t \), \( t_1 \), \ldots \( t_n \), are the orthogonal trajectories. Any two trajectories intersect equal lengths on the geodesics, and it is from this fact that the trajectories derive their name of geodesic parallels. If \( u \) represents the distance from \( c \) to a geodesic parallel measured on the geodesics, into the form
\[
ds^2 = G dt^2,
\]
where \( G \) is a function of \( u \) and \( v \) satisfying two conditions at the pole point:
\[
\sqrt{G} = 0, \quad \frac{\partial \sqrt{G}}{\partial u} = 0, \quad \frac{\partial \sqrt{G}}{\partial v} = 0.
\]

We mention, finally, a system of references in which the curves are geodesic ellipses and hyperbolas. If a point \( P \) moves so that the sum (difference) of its geodesic distances from two arbitrary curves \( c \), \( c_1 \) of the surface is constant, it describes what is called a geodesic ellipse (hyperbola); \( c \) and \( c_1 \) must not be geodesic parallels. Weingarten has shown that the system of geodesic ellipses and hyperbolas is orthogonal. A special case is when \( c \) and \( c_1 \) reduce to points. Liouville has investigated a class of surfaces on which there is an isothermal system of geodesic ellipses and hyperbolas. The form of the arc element is
\[
ds^2 = \left[ f(u) + g(v) \right] (du^2 + dv^2),
\]
and the differential equation of the geodesics can be integrated and brought to the form
\[
\int \frac{du}{\sqrt{f(u)}} = \int \frac{dv}{\sqrt{g(v)}} = b, \quad \text{where} \ a \ 	ext{and} \ b \ 	ext{are constants of integration}.
\]
second order and surfaces of rotation belong to the Liouville surfaces. Gauss established the theorem that the sum of the angles of a geodesic triangle (the sides are geodesic lines) is greater than, less than, or equal to, \(\pi\), according as the triangle lies in an elliptic, hyperbolic or parabolic region. The only surface that can contain an area of parabolic points is a developable surface (see 16), i.e., a surface developable upon a plane.

15. Representation of One Surface upon Another Surface. Conformal Representation. Applicability.—In map drawing one has an instance of the depiction or representation of one surface upon another. To each point of one surface corresponds a definite point of the other surface. The character of the depiction is a matter of the law of relation of the corresponding points of the two surfaces. If the equations of a surface \(A\) are expressed in parameters \(u, v\) and those of surface \(B\) in parameters \(\xi, \eta\), any equations \(u = g(\xi, \eta), v = h(\xi, \eta)\) will give a law of correspondence of points, provided that to a pair of values of \(u, v\) there corresponds a pair of values of \(\xi, \eta\), and conversely.

When each infinitely small triangle on the one surface is depicted in an infinitely small and similar triangle on the other surface, the depiction is said to be conformal. It follows that corresponding angles on \(A\) and \(B\) are equal; also that of \(A\) measured from a point \(P, ds\) the corresponding arc length on \(B\) and \(k\) a quantity depending on the position of \(P\) and independent of the direction of \(ds\). The analytical side of conformal representation is completely resolved by recourse to thermal parameters. The arc element of \(A\) in the thermal parameters \(u, v\) is \(ds^2 = a(du^2 + dv^2)\); similarly, arc element of \(B\) in the thermal parameters \(\xi, \eta\) is \(ds^2 = \beta (d\xi^2 + d\eta^2)\). The relations \(u + iv = f(x + iv), u - iv = f(x - iv)\), where \(f\) and \(\beta\) are arbitrary conjugate functions establish a conformal representation, since, by virtue of these relations, \(ds^2 = kds^2\). Any two surfaces can, in general, be conformally represented upon each other in an infinity of ways. The functions \(f\) and \(\beta\) can be chosen to furnish the most advantageous conformal representation.

Two surfaces are applicable or developable upon each other if the corresponding infinitely small triangles are equal in all respects. This requires that corresponding arc elements shall be everywhere equal, namely, that \(u_i\) and \(v_i\) shall be such functions of \(u, v\) as to transform the first member of the equation

\[
Edu^2 + 2Fdudv + Gdv^2
\]

into the second member. The letters with subscripts indicate the elements of the second surface. In general, this transformation cannot be made, and hence two arbitrarily given surfaces are, in general, not developable upon each other. It is obvious that all surfaces derived from a given surface by bending without stretching (see 8) are applicable upon each other. Hence the parameters of any one of these are applicable in the parameters of the original surface. All the surfaces may, accordingly, be assumed definite in the same parameters \(u, v\), whence it follows that the fundamental magnitudes \(E, F, G\) will be identically the same for the entire series of surfaces. The three magnitudes \(E, F, G\) and all functions formed from them and their partial derivatives are invariants of bending. Some important conclusions can immediately be drawn from these statements. We observe that the left-hand member of equation (\(\gamma\)) is the Gauss measure of curvature and that the right-hand member is a function of \(E, F, G\) alone. We conclude that the Gauss curvature does not change in any deformation of a surface by bending. One notes also that equation (\(\rho\)) depends only on \(E, F, G\), whence the theorem that a geodesic curve remains a geodesic in the deformation by bending.

As earth-dwellers the most interesting depiction to us is that of a sphere upon a plane. The sphere is not developable upon a plane and, therefore, any depiction is bound to be a distorted image of the original. A conformal representation will at least preserve angles, and the picture and original will be similar in the corresponding infinitely small parts. The two best-known examples of a conformal representation are the stereographic projection (Hipparchus, Ptolemy) and the projection of Mercator. Expressing the sphere of radius one in thermal parameters \(u, v\):

\[
x = \frac{2u}{u_i^2 + v_i^2 + 1}, y = \frac{2v}{u_i^2 + v_i^2 + 1}, z = \frac{u_i^2 + v_i^2 - 1}{u_i^2 + v_i^2 + 1}
\]

and a plane in thermal parameters \(u, v\): \(x = u, y = v\); the stereographic projection is furnished by the relations \(u + iv = u, u - iv = v\). For the Mercator correspondence one sets up the relations \(u_i + iv = u, u - iv = v\). Or \(u = u_i \cos \psi\), \(v = v_i \sin \psi\). In the stereographic projection the circles of the sphere are represented by circles (or straight lines) in the plane; in the Mercator map the meridians and parallels of latitude appear in the plane as a system of orthogonally intersecting right lines.

16. Ruled Surfaces.—The continuous motion of a straight line through a simple infinity of position generates a ruled surface. When the consecutive generators intersect, that is, when the generating line is always tangent to one and the same space curve, the surface is a developable surface. In the contrary case the surface is called a skew surface. The director cone of the ruled surface is formed by drawing through an arbitrary point of space lines parallel to the generators of the ruled surface. The equations of the most general ruled surface are

\[
x = a_1 + \beta_1 u, y = a_2 + \beta_2 u, z = a_3 + \beta_3 u
\]

where \(a_1, a_2, a_3, \beta_1, \beta_2, \beta_3\) are functions of \(v\) alone. The curves \(v = \text{constant}\) are the right-line generators; the curves \(u = \text{constant}\) are trajectories of the generators. The trajectory \(u = 0\) is sometimes called the director curve. The important elements are: (1) The angle \(d\) between two consecutive generators \(g_1\) and \(g_2\); (2) the shortest distance \(d\) between \(g_1\) and \(g_2\); (3) the value of \(u\) corresponding to the point,
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called central point, where the shortest distance meets \( a \). Putting for brevity
\[
B_1 = B_d B_3 - \beta d B_1, \quad B_2 = B_d B_3 - \beta d B_2, \\
B_3 = B_d B_3 - \beta d B_3,
\]
the values are
\[
ds = \sqrt{B_1^2 + B_2^2 + B_3^2}, \quad \beta_1, \beta_2, \beta_3
\]
\[
\frac{\partial}{\partial \beta_1}, \frac{\partial}{\partial \beta_2}, \frac{\partial}{\partial \beta_3}.
\]

The locus of the central points of the generators is a curve called the line of striction.
Its equation is the third of the group above.
For a developable surface \( \beta_1 = 0 \). The surface is cylindrical if \( B_1 = B_2 = B_3 = 0 \). The tangent plane to a skew surface at a point contains the generator through the point, and the plane rotates about the line as the point of contact moves on the line. The normals of the surface along a generator form a hyperbolic paraboloid. A ray may be made to move under a deformation by bending so as to remain a ruled surface. The developable surfaces are so named because they are developable upon a plane. Their linear element \( ds \) admits of being thrown into the form of the \( ds^2 \) of the plane.

17. Surfaces of Constant Gauss Curvature.

These surfaces are of three kinds: (1) Surfaces of constant positive curvature for which \( K > 0 \) or \( \frac{1}{\beta_1} \) is positive and constant at every point.
The sphere is the type of this class. (2) Surfaces of zero curvature for which \( K = 0 \) at all points. These are the developable surfaces (see 16) of which the plane is the type. (3) Surfaces of constant negative curvature, \( K < 0 \), of which the pseudosphere is the type.
The pseudosphere is the surface generated by rotating a tractrix about its asymptote.
Minding showed ("Crelle's Journal für Mathematik, 19, 1839") that all surfaces of the same constant curvature are developable upon each other, and in \( \infty \) ways. The geometry of figures on a surface of constant positive curvature may, therefore, be studied on a sphere; that of developable surfaces on a plane; and, finally, the geometry of surfaces of constant negative curvature is identical with that of the pseudosphere. All surfaces of constant negative curvature are called pseudospherical surfaces. In employing a geodesic polar system of reference (see 14) the \( ds^2 \) of pseudospherical surfaces with measure of curvature
\[
-\frac{1}{K^2} \text{ takes the form } ds^2 = du^2 + R^2 \sin \frac{u}{R} dv^2.
\]

A characteristic distinction between the geometries of the three kinds of surfaces of constant curvature is indicated by the number of geodesics that may be drawn through a point parallel to a given geodesic. On a pseudospherical surface two parallels may be drawn; on a developable surface only one parallel; on the surface of positive curvature, none.

18. Minimal Surfaces. — They are defined to be the surfaces of mean curvature zero, \( H = 0 \) (see 12). At every point of such a surface \( R_t = -R_n \). Historically the theory of these surfaces had its origin in Lagrange's investigation of the surface of minimal area with prescribed boundary curve. It was ascertained that for such a surface \( R_t = -R_n \) but the converse statement does not always hold without limitations. Integrations of the differential equation of minimal surfaces were given by Legendre, Monge and others. We give here the equations as found by Weierstrass:
\[
z = \frac{1}{2} \int (1 - u^2) F(u) du + \frac{1}{2} \int (1 - v^2) F(v) dv,
\]
\[
y = \frac{i}{2} \int (1 + u^2) F(u) du + \frac{i}{2} \int (1 + v^2) F(v) dv,
\]
\[
s = \int u F(u) du + \int v F(v) dv.
\]

\( F \) and \( F_i \) are concurvate functions of the conjugate complex variables \( u \) and \( v \). All minimal surfaces are contained in these formulas. When the function \( F \) is algebraic the surface is algebraic, and conversely. A minimal surface can be deformed by bending so as to remain a minimal surface. For this it is necessary and sufficient that one replace \( F(u) \) and \( F(v) \) by \( \varphi(u) \) and \( \varphi(v) \), respectively. All the surfaces corresponding to values of \( a \) (real constants) are developable upon each other as having the same \( ds^2 \). The only ruled minimal surface is the ordinary helicoidal surface with director plane. The only minimal surface of rotation is the catenoid, i.e., the surface generated by rotating a catenary about its base. These two surfaces are developable upon each other. The minimal surface is the only surface (aside from the sphere) whose spherical representation is conformal (see 12 and 13). For particular as to these surfaces consult Schwarz, "Gesammelte Mathematische Abhandlungen" (Vol. I, 1890); Darboux, "Leçons sur la Théorie Générale des Surfaces" (Vol. I, 1887).

19. Concluding Remarks. — In addition to the special surfaces here described may be noted the surface of centres, i.e., the locus of the centres of curvature of a given surface. It consists of two sheets \( S_i \) and \( S_j \) corresponding to the two centres of curvature at every point. Also may be noted the \( W \) surfaces or Weingarten surfaces, in which \( R_1 \) and \( R_2 \) are functionally related. A functional relation, \( f(R_1, R_2) = 0 \), defines an infinity of surfaces. In passing to the surface of centres of individual such a group, Weingarten showed that all the sheets \( S_i \) are developable upon each other and upon the same surface of rotation. The same theorem holds for curves for the sheets \( S_j \). Surfaces of constant curvature, and minimal surfaces are special \( W \) surfaces. Finally, there are certain analytical expressions constructed in the fundamental magnitudes, some arbitrary functions, and derivatives of the functions, which have the same value whatever the parameters employed. In particular, quantities invariant with respect to a change of parameters. When the arbitrary functions are present they are called differential parameters. When the arbitrary functions are not present they are called differential invariants. Manifestly these magnitudes are connected with those geometrical properties that are essentially independent of the particular system of parameter reference. For example, Gauss curvature
\[
-\frac{1}{R_1 R_2 R_3}
\]
is obviously an invariant.

Bibliography. — Some of the principal treatises on the theory of surfaces are Darboux,
SURGEON IN ARMY AND NAVY OF UNITED STATES—SURGERY


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SURGEON IN THE ARMY AND NAVY OF THE UNITED STATES. The history of the connection of a regular staff of surgeons to the army dates back to the siege of Boston in 1775. At that time the Second Provincial Congress of Massachusetts Bay was in session and on 8 May 1775 appointed a committee to examine such persons as are or may be hereafter surgeons for the army now forming in this colony. Of the 16 candidates examined only six were rejected. On 21 July 1775 Washington urged in a letter to the Continental Congress that a 'Hospital Department be established,' and on 27 July this department was created, having a director-general, chief physician and 20 surgeon's mates. In April 1776 Congress passed an act that the board of surgeons be increased 'not exceeding one surgeon and five mates to every 5,000 men to be reduced when the army is reduced.' Between 1784-89 no medical department was officially recognized by the government, but was in the latter year recognized and remained the same until 1821, when it took the form which it retained with no decided change until 1908 when the titles of all medical officers, excepting the surgeon-general of the army, became the military rank, major, captain, etc., followed by the words, Medical Corps, U. S. A. Applicants for the medical corps must be between 22 and 30 years of age, be citizens of the United States and graduates of a reputable medical school and must have had at least one year's hospital training. After successful examination they are commissioned as first lieutenants. The Act of 1908 also established the Medical Reserve Corps, the members of which rank as first lieutenants and are appointed by the President after an examination. During the Civil War and the Spanish-American War the corps was increased to meet the emergencies, but on the cessation of hostilities was again placed upon a peace footing. Consult Lamphere, 'United States Government' (Philadelphia 1880); Farrow, 'Military Encyclopedia' (New York 1885); Hambley, 'Army and Navy Register' (New York 1888) and other War and Navy Department records. See United States, Army of the; United States, Navy of the.

SURGEON-FISH, a fish of the family Trichiuridae, allied to the butterfly-fishes (q.v.) and distinguished by the presence of one or more dark bands running like a belt from the forehead and the root of the tail which may inflict an ugly wound. Some 80 species are known, mostly of the genus Trichiurus, scattered through the warm seas of the world and variously known asdoctorfish, lancet-fish, tunny and among the Spanish-speaking fishermen of the West Indies as barberos and médicos. All are oblong, compressed, brownish or bluish fishes from 6 to 12 inches long, with narrow protruding incisor-like teeth. Several are good food, especially the ocean surgeon-fish (T. bohunus) found throughout the West Indies, and the blue tang (T. carolus), found near Porto Rico.

SURGERY. History of General. The history of medicine, fascinating at all times, is most valuable to the surgeon when applied to the subject of general surgery. At the present time there is much in the literature of medicine that is very instructive and it becomes more and more so as we are put in possession of facts pertaining to prehistoric man and of those presented in the study of manuscripts antedating the Christian era.

Skulls of the prehistoric period have been discovered in caves and dwelling-places which show undoubted evidence that trephining had been performed on them and that healing of the bone had later taken place. The examination of these specimens is exceedingly interesting. Again, as we study the man of this age and the beginning of the Christian era we note a great deal that leads to the conviction that surgery was understood in those times. The early embalmers, in their familiarity with the human body, must have acquired some knowledge of surgery, and this as far back as 1700 B.C.

While medicine as a profession was confined to the duties of the priest, surgery suffered, and was more and more neglected. Historians of that time have just reason to condemn Egyptian surgery. There are some very excellent books appearing at the present time giving a full description of what little was known, bestowing full credit upon those who practised surgery, or advocated it, and who were making some progress in that branch of medicine. The Egyptians were proud and fond of their work as scribes or writers, their learning in that direction leading them to advise their sons to take up what was then known on the subject of medicine; but very little seems to have been developed in the way of clinical observation, or, more particularly, in surgical procedure.

In the study of medicine by the Hindu one cannot but note that in their writings there is plain evidence that surgery had reached an advanced stage. *Surgery,* says their great Susruta, is the first and highest division of the healing art, least liable to fallacy, pure in itself, perpetual in its applicability, the worthy produce of heaven, the sure source of fame on earth. He also makes the very excellent observation that he who knows but one branch of his art is like a bird with one wing. This writer was a very careful observer and beyond doubt did much to advance the art of surgery centuries before the birth of Christ. Some of the Hindu works and operations are yet spoken of by modern writers. They knew how to perform successfully the operation of developing a new nose by flaps taken from the face, and were familiar with these procedures. The surgery of ancient India is worthy our most thorough and careful investigation. Great interest is being manifested in its study and there can be no doubt that it will result from the recent organization of the Charaka Club in
New York. This body of investigators bids fair to give us papers of great value in the elucidation of that period when Hindu surgery developed—and, it may be said, ceased. Why it disappeared so mysterious ly has never been shown.

Through the study of manuscripts of succeeding centuries, and of other records of different peoples, one is greatly impressed with the difficult operations performed, now and then, by some predominating man, who, perhaps having more knowledge of the anatomy of the human body, and being somewhat bolder than his fellows, would perform an operation, leaving a report of possible success. Then for centuries this work would be forgotten, then revived, perhaps modified. Possibly to the operator it was a new operation (since he was not aware that it had been performed previously), yet to be developed into a line of work that was to lead to greater success. Thus we see reported very important advances in the line of surgical procedure from our earliest knowledge on.

The early Greek knowledge of surgery is not so apparent or abundant as that of later periods. Yet this primitive medicine gives endorsement to the fact that there were surgeons capable of rendering aid in emergencies, such as the removal of foreign substances from the body, and who were able to control bleeding by the application of what were evidently understood to be drugs possessing some styptic power and to bind up and dress wounds. Even fractures and dislocations were treated. In time of war these men were looked upon with reverence and the aid they were expected to render was highly valued. Of their real work there is little known before the Trojan War. The most observing student of cases in antiquity was Hippocrates (q.v.) born 460 B.C. He wrote on the treatment of articulations, luxations, fractures and also on the subject of the use of instruments, but his knowledge of anatomy must have been very meagre. The Greeks had great respect for their dead, which prevented dissection of the human body. They knew nothing of physiology and, therefore, anatomical structures such as arteries, veins, nerves, tendons, ligaments and membranes were hopelessly confused. Hippocrates gave classifications not unlike those of the present day, "internal medicine" and "external or surgical medicine," which were convenient, but not philosophical. The period of his life marked the transition from mythology to history. His doctrine and clinical observations were received with great respect. He advanced the science and art of surgery, but only a little later ignorance again reigned in the school which he made celebrated.

Erasistratus (about 300 B.C.) was a close observer as an anatomist and made use of his knowledge of physiology. He discovered the lymph vessels, described the epiglottis, successfully removed the spleen and performed other remarkable operations.

Aretaeus was one of the most brilliant men of the second century before the Christian era. He introduced surgical aftercare of the brain and described the Syriac or Egyptian ulcer, tetanus and anal fistula.

Galen (q.v.), who died about 201 A.D., must have had considerable knowledge of anatomy. History indicates that he was a vivisector, and to him is due a clear classification of the muscles, which is followed at the present day, as the "flexors and extensors." He came very near discovering the circulation of the blood, and divided the body into the "cranial, thoracic and abdominal cavities," whose proper viscera and envelopes he described. This was during a period when encouragement was given to the study of anatomy. The works of one Orissors (q.v.), who died about 400, were based on the writings of those who had preceded him, but had a distinct importance of their own. He showed much originality in the treatment of hydrocephalus, advised paracentesis of thorax and abdomen, removal of vesical calculi, treatment of aneurism, excision of hypertrophied mammae in men, etc. Antyllus who flourished about this period was one of the most distinguished and original surgeons of antiquity. He was the first to describe the extraction of small cataracts and is perhaps best known to the surgical world of to-day by his beautifully bold plan of opening aneurisms, so successfully imitated by the late James Symes.

It is to be remembered that during the Greek period Galen and his followers dissected animals and occasionally a corpse on the field of battle.

In the 6th and 7th centuries the Arabians gave more encouragement to dissection and demonstrated that surgery required a knowledge of anatomy. One of the most celebrated Arabian physicians was Rhazes (q.v.), who died about 932. He compiled from the authors some 37 books on medicine and surgery.

Albucasis (936-1013) in one of his writings gives a most detailed account of necessary instruments and in speaking of their proper use and application to surgery, he emphasizes the fact that surgeons should be versed in the science of anatomy.

In visiting the various museums in Europe at the present time, especially Naples, one is greatly impressed with the variety of ancient surgical instruments that have been recovered from the ruins of Pompeii and other former surgical centres.

Avenzoar (q.v.), who died about 1169, wrote one of the most remarkable treatises on renal diseases, especially in reference to the treatment of calculi and further surgical intervention.

From the 9th to the 13th century the Jews and the Christian clergy shared the honors of the healing art, and during this time references are not infrequently made to the work of the barber-surgeon (see BARNES). Lithotomy (q.v.) seems to have been developed in this period and it is noted (1022) that Henry II, Holy Roman emperor, was cut for stone by Saint Benedict himself.

In the 13th century Rolger of Palermo was evidently one of the most distinguished pioneers in modern surgery. He was the first to use the term "seton." His pupil, Roland, wrote a treatise on surgery, which became very famous and was mentioned by Guy de Chauliac, the "restorer of French surgery in the 14th century." The latter was probably one of the most famous surgeons of that time. He opened the abdomen for dropsy and operated for the radical cure of hernia and for cataract.
The history of the school of Salerno in the 13th century indicates that plastic surgeons had to devote a certain time to the study of anatomy, were obliged to pass an examination by the faculty of the university and were licensed by the royal hands. Surgeons recognized the importance of nausea, vomiting and hemorrhage from the ears, in injuries to the head. They used the trephine (q.v.) in treating fractures of the skull and treated hernia cerebri by pressure and caustics. Ligatures were used in wounds of the carotid arteries and jugular veins. The surgeons also treated wounds of the abdomen. Lithotomy was described with care and compound fractures were treated with splints.

The first important work on minor surgery appeared during the 14th century. It was written by Lanfranc, but although it grew into a second and larger treatise, surgery soon after this began to decline. The barber-surgeons of this period were possibly the first to impress upon the profession the importance of searching in the cadaver for the concealed cause of disease. His observations on gall-stones and conveyance of syphilis from the mother to the fetus were original.

Notwithstanding the progress in surgical science during the 15th and 16th centuries, the practice of surgery was largely abandoned to a class of ignorant barbers and bone-setters. Most of these operators traveled from city to city, individual practitioners limiting themselves to operations on stone or for hernia. This condition of affairs, together with the prejudice against dissection, was most unfavorable for the profession of surgery.

France at this time presented the only special college for the instruction of surgeons. To the 16th century belongs the career of the most wonderful surgeon, Ambroise Paré. He was an original thinker, had the courage of his convictions and did away with the use of the cautery and boiling oil in amputations, using ligatures to control hemorrhage, the latter being the most important advance until the introduction of ether in 1846 (see ANESTHETICS). At the beginning of the 17th century surgery reached a higher social and intellectual plane than it had heretofore occupied. Amphitheatres for dissection developed in many European cities, together with hospitals and dispensaries in connection with the various schools. The term inflammation was then introduced and from that time until the present day has been a subject for continuous investigation. From this time surgery may be dated. The beginning of consultation work between expert practitioners; and clinical teaching and the presentation of surgical cases then advanced their claims. Surgical history from Valsalva on presents the names of many who became eminent operators, and in their writings did much to advance the art of surgery. Notably was this to among the Italians, who in their plastic surgery developed the Italian method for construction of a new nose.

In France, Morel (1674) invented the tumniquet, Denis performed the first transfusion of blood in man and other French surgeons became very expert in the operation for lithotomy. Mareschal (1658-1736) had a record of eight lithotomies performed in half an hour. He was one of the founders of the French Academy of Surgery.

In Holland, Rau (1658-1719) taught practical surgery upon the cadaver. Wiseman (1625-86) was the first to develop English surgery. He was also the first to do external urethrotomy for relief of stricture. At this time in France alone was instruction in surgery well regulated, as it was the only country which possessed a proper surgical college.

In the 18th century hospitals began to multiply in Germany, benefiting general surgery to a great extent. Brasted (1711) described the method of distal ligation of aneurisms, while Sabatier (1732-1811) wrote a treatise on operations and recommended resection of the head of the humerus. Desault and Chopart did much in developing operative surgery. In Italy Scarpa (1752-1832) advanced our knowledge of hernia and aneurisms. Spanish surgeons did little to improve the science and art of surgery. In England, Cheselden (1688-1752) did much in advancing the knowledge of pathology and general surgery. White, of Manchester, designed a method of reducing dislocations of the humerus with the foot in the axilla. A well-defined operation for excision of the joints was also first practised in England. The investigation of pathology and diagnosis in France at this time had much to do in the 19th century in developing the *new Vienna School*. Percival Pott (q.v.) did much in elaborating and classifying diseases of the joints and especially spinal diseases. John Hunter (q.v.) was the most famous English surgeon of his day. He belonged to a family which in many ways assisted the development of pathological anatomy and surgical technique. At the close of the 18th century, Benjamin Bell was the first to make use of drainage by means of tubes of lead or silver. In France, Bichat (q.v.), although not generally so understood, became a forceful lecturer on surgery and did much to bring hospital-gangrene under observation and control. The Dutch during the 18th century developed some eminent surgeons, and it is interesting to note how dextrous they became in the use of instruments. At the same time their knowledge of anatomy enabled them to present some very able papers on the subjects of hernia and dislocation. Sandifort, of Leyden, first described a downward dislocation of the femur.

In reference to the surgery of our own country in the 18th century, one of the most interesting works, which was of great service to American surgeons, was that of John Jones, *Plain, Practically Precise Remarks on the Treatment of Wounds and Fractures.*

The 19th century witnessed great advances and from 1838 was one continuous chapter of investigation toward the development of the
parasitic or germ theory. Of all the many names associated with this immense work, one can refer to but few: Pasteur, Klebs, Koch, Lister, Tyndall (q.v.) and others, in their development of bacteriology, have done more to advance the principles of technique in surgical operations and have placed the art and science of surgery upon a more lasting foundation, than any of their predecessors.

The first half of the 19th century was a period of great success for the French surgeons. The English surgeons, in their superior knowledge of gross anatomy, also made great advances in their diagnosis and surgical treatment. This century became noted as the period during which general surgery developed more into an exact science. Its writers did much to eradicate erroneous ideas and to end the transmission of meaningless sentences from one textbook to another. The introduction of anesthesia in 1846 enabled some of the bold men to perform operations heretofore deemed quite impossible and the rate of mortality was reduced from 60 to 6 per cent, and this ratio was soon applied to all departments of surgical work. As technique became more perfect, all manner of operations were suggested and carried out with great success. Hence to-day there is no part of the human body that the surgeon is unable to reach for the relief of injuries or pathological conditions.

In operative surgery much help has been received from the use of cocaine, eucaine, suprarenal extract, ethyl chloride and other preparations for local and spinal anesthesia. Bacteriology has taught the surgeon the cause of inflammation, suppuration of wounds and sepsis. New hospitals, aseptic operating-rooms and furniture, thorough sterilization of instruments, bands and the field of operation and cleanliness of person, together with the wearing of rubber gloves, coupled with aseptic dressings, have enabled the surgeon to perform operations unknown before the last decade of the 19th century, and in a short time reduced from 60 to 6 per cent, and this ratio was soon applied to all departments of surgical work. As technique became more perfect, all manner of operations were suggested and carried out with great success. Hence to-day there is no part of the human body that the surgeon is unable to reach for the relief of injuries or pathological conditions.

During the 19th century the microscope became of more and more value. The anthrax bacillus was classified in 1850 and then followed classification of the various micro-organisms known to-day. Koch's identification of the tubercle bacillus has aided the general surgeon as much in the treatment of osseous tuberculosis as it has the physician in tuberculosiis in other parts of the body.

In the past two decades general surgery has presented a mass of material, largely experimental, and much of it bacteriological and pathological. The latter has assumed a better position because of some real practical discoveries, but the former has brought about a large lifting out of much that was thought of great value, experience, however, demonstrating to the contrary. Let us consider the treatment of fractures. The various methods of plating and suturing, by means of silver wire, have had very strong advocates, yet in the use of splints, extension and position have retained their well-recognized effectiveness. There would seem to be a consensus of opinion that when the X-ray shows the fracture has been reduced and the parts brought into a fairly normal position, these cases do fairly well without operative intervention; however, when the positions are faulty, and, even though an anesthetic is employed, reduction cannot be accomplished satisfactorily, there can be little doubt that they do very much better and more perfect results obtained, by operative procedure. It is now becoming recognized the fractures of the clavicle and other irregular bones demand operative intervention, by employment of plates and like methods.

The knowledge of the anatomical relations of the various joints, especially that of the hip and shoulder, with the aid of X-ray, manipulation, becomes more perfect and more reliable in results.

In dislocations the X-ray has continued to demand greater employment because of its worth.

In the past 10 years it is pleasing to observe that the methods of scientific X-ray work have become very much more extensive and precise; that the X-ray apparatus, in examinations of the head, thorax, abdomen, pelvis and extremities, greater precision has been reached and the results much more reliable and satisfactory; that in the understanding of the location of foreign bodies, much has been accomplished in reading the shadows correctly.

It is in the diagnosis of fractures and dislocations that there has been a steady, continuous improvement. This observation becomes very appropriate when referring to lesions of the spinal column and surgery of the spinal cord.

This knowledge also applies to the better understanding of pathological conditions, especially within the abdomen and the location of stone in the kidney and bladder; however, this must be said, that in the past few years physicians, surgeons and specialists have come to recognize the Roentgenographer as the one alone who can interpret the radiograms and make it clear to the surgeon who is responsible for the case, when an operation is undertaken. In the past it has been too much the custom for the attending medical man to translate the X-ray picture himself and many errors have occurred in that way. This is especially true in reduction of dislocations.

Operations upon the head and teeth, due to the study of X-ray work, have become much better understood, the classifications calling for such procedure much more reliable and showing more and more perfect results.

Comparatively recent parasology has demonstrated that septic teeth have much to do with the development of many surgical lesions, in the past overlooked, and, which, like the tonsils, frequently become the bed for the introduction of pathological micro-organisms into the system.
There has been added to the history of general surgery a very interesting chapter on the treatment of phlegmons and inflammatory septic conditions, by employment of the method known as passive hyperemia. When promptly and effectively made use of it is of great value in cutting short infective invasion of the lymphatic system, especially when applied to the extremities.

The treatment of malignant disease by means of serums, especially Coley's fluid, maintains a semi-successful position, but, considering the length of time it has been employed, it would seem as though it ought to have offered more encouraging results.

The same applies to X-ray treatment, advocated by some so earnestly in its use previous to, and after, an operation for relief of malignant troubles, yet not establishing itself as a positive curative agent.

The range of general surgery is becoming so great, the multiplicity of theories and papers proposing such new and seemingly superior methods so great, that one can hardly hope to make any great contribution to the methods of diagnosis and treatment that may be said to be final and the results such as to command the confidence and respect of the operator. The history of modern methods, regarding general surgery, in pathology and diagnosis, through bacteriological, laboratory work, is wonderfully encouraging, but much more time is required than was made use of by the surgeons of a somewhat receding and later date, in their examination of cases.

The thorough study of the blood, bacteriologically and otherwise, the vaccines, are all to be considered in the present history of surgery and proving elements of great importance. This applies to all modern surgery, reaching all points that have developed through research work and of great use in the study of general surgery to-day.

In the study of the history of general surgery, the many papers that are presented in our medical journals, also in our textbooks, from year to year, it is to be observed that advances are being made in the methods of diagnosis and proper treatment. There is this constant evidence that exploitation of supposed new discoveries, in their proper relation, have failed to maintain the expected high standard of success, for instance, in appendectomy. At first suggestions for this operation met with a great deal of encouragement in the hope that, as the appendix was permanently fixed in the incision, it could be made the source of successful treatment of pathological changes within the large intestine; however, it does not seem to have found approval to the extent of many cases appearing on record, or employed so extensively as at one time thought possible.

Also, while there have apparently been a few excellent results, yet Edebohls's suggestive treatment of nephritis, by decapsulation of the kidney, does not seem to have sustained the endorsement of the pathologist or the operating surgeon.

In the changes and successes in diagnosis and treatment, during the past decade or two, great progress is to be observed in comparing one period with another — one method with another. That of which so much was expected too often proves valueless, while that which seemed of lesser importance proving of great value, on trial.

In civil life the advances made in surgery of the head, face, neck and thorax, the mediastinal space, the heart, of the lungs and pleura, indicate the calm, steady progress that is now to be observed in all larger hospitals.

Especially does this apply to stab wounds of the heart, to the drainage of abscesses within the pericardium, also in operations upon the lungs and treatment of the pleura for various surgical conditions.

The recent acquisition of the pathology of the thyroid and parathyroids has resulted in the understanding of goitre, far ahead of anything that has ever taken place in the past. The function of these glands, the classification of symptoms and of the pathological condition, has enabled the surgeon to do his work in a more scientific manner and the results much more favorable. The better understanding of the term exophthalmic goitre is exceedingly pleasing in every respect.

In abdominal surgery it is no longer necessary to make use of theories, for practical facts are such that, for instance, in surgery of the liver, gall-bladder, pancreas, gall ducts, the pancreatic ducts, there is now a fixed line of treatment, and not to be deviated from very much. This is becoming more and more positive, and also applies equally well to the appendix.

The surgical treatment of gastric and duodenal ulcer is one of the finest demonstrations of surgery being made more of as an exact science than internal medicine has yet attained.

Injuries and diseases of the pancreas and spleen illustrate much of the advance made in the field of diagnosis and treatment.

The abdominal cavity has come under such thorough observation that the right side can no longer hold its exclusive position regarding operative intervention.

There is no part of this one classification of the human body, and in which Galen was so correct, that is entirely free from possible invasion.

In the past two decades much has been added to our knowledge of intestinal surgery and methods of treatment have reached a more conclusive line of operative procedure.

In civil life no more brilliant results can be shown in any of the various departments of surgery than the treatment of multiple gunshot wounds and ruptures of the intestines and other organs within the abdominal cavity.

This applies particularly to hernia — rupture — and especially for relief of gangrene of the intestine. To the surgeon of many years practice, it is particularly striking to note how few cases we now come in contact with of delayed strangulated hernia, in which we have the complication of gangrene of the bowel. The prompt recognition for early operation in such cases has largely eliminated this catastrophe. Our pathological knowledge is much more clear, also the willingness of the patients to have an early operation, and not trust to mechanical supports. These cases, treated, as they often are, comfortably and palliatively by the applica-
tion of trusses, still continue to present an excellent history in the good results of operative intervention. We see a gradually increased willingness, in fact patients often seek an opinion when the result has been so thoroughly satisfactory. All of this applies as well to children as adults.

In the treatment of conditions within the abdominal cavity, a greater concensus and uniformity of opinion has been reached than in some other surgical channels.

Perhaps we may say there is yet a lack of uniformity in doing the operation of intestinal anastomosis.

Excision of the large intestines seems to have reached the peak of operative intervention, and present results are being studied with great care, regarding curative results in this class of surgery.

Surgery of the appendix gives a very extensive history, upon what has been written in the past, and, now, regarding diagnosis and treatment, becoming very concise. The general practitioner of to-day is more alert than ever in the recognition of early symptoms and prompt surgical procedure. When these methods are yet more thoroughly considered and carried out, the appendix, from the medical and surgical standpoint, will present a mortality much less than exists at present, though this is exceedingly small.

The history of operations done upon the bladder, for various pathological conditions, is a very impressive one. Decided advances have been made in this direction, and the same can be said of the prostate gland, while surgery of the kidney has reached a point of great precision, the same also to be said regarding the ureters.

In all that pertains to the surgery of the abdominal cavity, much has been accomplished through the study of the Trendelenberg and other positions for the patient during the time of operations, especially upon the kidney or gall-bladder and in pelvic work. Much of this also applies to the treatment of the patient after an operation, particularly in suppurative, septile appendicitis, as has so well been brought out by the writings of the late Dr. Fowler.

In the advances made within the abdominal cavity the searching out of every pathological condition, no organ or tissue being overlooked, is one of the most impressive to be noted in the history of general surgery.

Gall-stones have a way of giving a great variety of symptoms, the same applying to cases of appendicitis, and which, perhaps, has brought out many valuable conclusions.

In the history upon one of these organs and not finding a pathological condition that will accord with the symptoms, it is admitted by most surgeons that a more thorough examination is called for, and in some other unsuspected organ may be found the source of the symptoms, relief being afforded only by doing the operation called for in that direction.

Since the last edition of the Encyclopedia Americana much has occurred in the history of general surgery, regarding surgical procedure, to make clearer new fields of observation, and which applies especially to the abdomen and its contents.

The abdomen has claimed much of the attention of the general surgeon. It has not been possible for the specialist to control this line of work. With our increased knowledge of pathological conditions within this cavity, with the aid afforded the operator through the advances made by the assistance of the experienced radiographer, who is able to interpret radiograms correctly, the success has been so great that patients, or their friends, have little hesitation in entering a hospital, or going to the operating table, when the necessity is made apparent to them. Hence in the building of the many smaller hospitals the past few years, local surgeons have developed an experience that permits of doing many operations deemed impossible for them to perform a few years ago.

In the past two decades much progress has been made in surgery of the bones; in the conservation of limbs and joints; in the better understanding of pathological conditions and especially does this apply to cases of malignant and tubercular troubles.

Surgical lesions of the circulatory system have received much attention, and surgeons have had occasion to discuss the subject of idiopathic aneurisms. Operative surgery in the near past has not met with so many of these cases, and the condition is believed to be due to the more successful treatment of syphilis, this being one of the chief factors in development of this lesion.

The subject of inflammation of the veins—phlebitis—has commanded careful investigation in our laboratories, it so often being the factor in connection with sudden death following an important operation. To relieve the blood clot that forms in the vessel, then suddenly separates, enters the circulation, plugging the heart valves and causing sudden death, calls for surgical intervention, when it can be recognized as being present in the large veins of the extremities.

It is also to be observed that a less number of cases of stone in the bladder are presented, due to the better understanding of calculi originating within the calyces, and condition corrected by the study of diet, the drinking of properly selected mineral waters or the careful use of plain sterile waters. Here diet has much to do in lessening the development of many surgical lesions.

The medico-legal side of the responsibility of the surgeon has been pretty thoroughly covered the past few years in the history of malpractice suits for foreign bodies left in the abdominal cavity, with the result that the operator, the hospital, and the surgeon alike the responsibility, and must give evidence of having exercised every precaution possible to avoid such occurrences. Especially is it the duty of the surgeon to have it well understood with the one nearest in relationship to the patient regarding the extent of an operation. If, in the midst of it, it is found necessary to do more than was explained, the operator must communicate with the responsible person regarding the condition present that requires greater operation.

In proceeding to present the results of operation, we find a conclusion why every cautious surgeon desires some person near at hand to inform them, should complications unexpectedly arise.
British surgeons have had some unpleasant experiences in this direction.

Regarding the anesthetic in use by the general surgeon, it may be said that sulphuric ether is undoubtedly employed to a greater extent than any other anesthetic. Chloroform is believed to be advisable in the short operations, and in those upon children, while for those only requiring a few moments the nitrous oxide or ethyl chloride are of great service.

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**SURGERY IN AMERICA.** If at any time one should purpose writing a history of the progress of surgery on the American continent he must not fail to remember that in the earlier part of its history America was absolutely dependent on Europe, and could not be expected to reflect anything better in the direction of science than that which it received from its mother-country. Therefore, the most suitable form could be made for the history of surgery on this continent would be a review of the status of the 17th century in Europe. Very prominent were two or three philosophical systems which had been handed down from previous thinkers. The skepticism of Montaigne, with its final reduction by Bayle to universal doubt or universal credulity, and the supernatural or mystic philosophy of Böhme, sometimes spoken of as the cabalistic or theosophistic, which includes the discoveries of Pascal and Malebranche, were the prevailing systems or methods of thought. In the meantime Bacon had lived and died (1626), who, though he laid great stress on gunpowder and the compass, had but little respect for the discoveries of Copernicus. Zoology and botany were fairly well advanced and had been extended by dissection and by classification. Hooke had discovered the cell, and had founded the cell-doctrine. Kepler and Galileo had been persecuted and had left their discoveries for others to verify. Newton entered the world some years after the date of the first expedition of the Mayflower (1642). Continental Europe had many universities, some of which have been discontinued or merged into others. Numerous academies of science had sprung up in different parts of Europe, and the present British Royal Society was remodeled in 1662 by Charles II. Nevertheless, all kinds of superstition prevailed, alchemy flourished, witchcraft was in full bloom, necromancy was generally practised and the divining rod flourished, and all domestic animals were kept under cover during an eclipse lest they be threatened by dire pestilence of unknown character. In 1628 Harvey had published his work on the circulation of the blood, and in 1608 the microscope had been invented by Lippersheim, although by some its invention is attributed to Jansen in 1620. At all events it was greatly improved by Hooke, who died in 1702. Logarithms were not invented until the American colonies were nearly 100 years old (1690); Newton's theory of air had been established by Toricelli in 1643. Previous systems in medicine were then modified, to be reformed on the modified Paracelsism devised by Van Helmont or the humoral views of Sylvius and Willis. Sydenham appeared upon the scene about the time of the first expedition of the Mayflower, and, until his death in 1689, the larger number of English physicians who came over in his day had been more or less under the influence of his teachings.

The 17th century is important in the history of surgery, since superstition and self-satisfaction gradually gave way to the inductive method and improved habits of observation. Even among the Dutch, who settled new colonies in this country, surgery was considered a divided position, while among the English, French and Germans it had already attained something of this character. These were still, however, the days of the barber-surgeons, who were not considered gentlemen nor fit to associate with gentlemen, who were, for the greater part, an uneducated and illiterate class. The study of anatomy was still pursued with difficulty, the ban of the Church yet covering those who took part in any operation which was accompanied by the shedding of blood. In the earlier times, the French were its mother-country, the Netherlands and France, while still worse was Spain, at the time when the early adventurers or pilgrims from these various countries landed upon our shores and began to make America.

**Colonial History.**—The English colonists brought their physicians with them on nearly all of their expeditions. Thus when Jamestown was founded, in 1607, we hear of one Wotton, or Woolton, who came out as surgeon of the London Company, who was even considered a gentleman among the others of the expedition, whether by courtesy or right it is not known. Walter Russel followed in 1608. Even within that first half-century came the need for some definite laws regulating the practice of medicine, since throughout the colonies quackery flourished to a considerable extent. There was at this time little to attract travelers to this country except the spirit of adventure, which the better educated men possessed in minor degree. Many of the earlier physicians of the colonies were church deacons or politicians or both. Thus Samuel Fuller, who came to Plymouth in 1620, preferred to be known as a deacon rather than as doctor, although he practised medicine faithfully and, for his time, well. John Winthrop, Jr., was not only a physician but a statesman. In 1667 he became governor of the New Haven colony, and he must have enjoyed much repute in England since he became one of the founders of the Royal Society. Up to 1692, 134 physicians had been catalogued as practising in the colonies. The first person executed for witchcraft was one Margaret Jones, who was also a physician.

In the New Netherlands, controlled first by the Dutch West India Company, it was provided in their charter that they should procure a "Comforter for the Sick." The first one of prominence under this provision was Bogaerdet in 1637; later came LaMontaigne, who was both a Huguenot and a physician. Prominent during the middle of the century was one Samuel Megapolensis, who was born in this country and graduated from Harvard in 1657, and then went to Utrecht, where he took his medical degree. He practised in Manhattan both as a physician and preacher. In 1772 a Quaker, George Fox, was traveling with John Jay when the latter
was thrown from his horse and had his neck apparently broken. Fox at once instituted a manipulation by which, apparently, the dislocation of the upper vertebrae was reduced and by which Jay was restored to life. This must be one of the earliest cases of reduction of the vertebra.

When William Penn came to this country he brought with him Dr. Wynn, an accomplished Welshman and probably the most competent man of his profession in America at that time.

The colonies were swept during this century with fierce epidemics of yellow fever, smallpox, scurvy, dysentery and many other diseases, by which the colonists suffered great loss. Those who came over with William Penn numbered about 100, of whom one-third died on the voyage of smallpox. This was perhaps the most terrible scourge of all and was not successfully battled with until Dr. Boylston dared to institute the method of inoculation to which his attention had been called by Mather, who had read of its successful introduction into England from Constantinople by Lady Montague. In this is constituted one of the most interesting episodes in the history of medicine in this country. Pull, who was a father who must have regretted that he had not his mind even after he had lost his interest in the burning of witches. In 1721 he read a paper on Turkish inoculation written by an imbecile, and he had no interest in it. He endeavored to interest various young men, especially a Dr. Douglas, in the discovery and in the method. Failing in this he turned to Dr. Boylston, then of Brookline, Mass., who saw the importance of the method and the ripeness of the occasion. As soon as his purpose became understood he was at once denounced in the pulpits and attacked by the multitudes, and had as his only backer the man Mather, who had not yet lost his authority with the clergy. Opposed, then, by his colleagues and by the clergy in general, and the universal rabble, Boylston had the hardihood to inoculate first his own son and two negro servants, and this only six weeks after the first inoculation was done in Montague’s London, by Maitland. But Boylston lived to reap glory and profit from his intrepidity. The controversy which he aroused had subsided in this country when he went to London, where he found it still raging, and where he again aroused a storm, but eventually triumphed. (This method must not be confused with vaccination, but consists of the actual inoculation of the disease by pus or discharge from the lesions of the patient suffering from the real malady. It is practically the same method which had existed for centuries in the Orient).

A great part of the 18th century was spent in warfare between natives and the newcomers to this country. The Indians were not always active, while the English and French fought more or less continually, the scene of conflict extending from Quebec on the north to the Niagara Frontier on the west and Georgia. In spite of the many opportunities thus afforded for the study of surgery it does not appear that much was done in the way of improvement of older methods or in new discoveries. The wounded soldier of 1776 had but little better treatment than the wounded pilgrim of 1666. There were a few men of such prominence scattered along the coast line in the early and middle part of the 18th century that they deserve to be mentioned, at least by name. Cadwallader Colden was born in Scotland in 1668, and came to this country in 1707, where he was the first doctor in Philadelphia. Here he wrote some of the first medical papers written in this country, particularly on animal secretion. After some years spent in this country he took up his residence in New York, in 1719. He was one of his life an indefatigable student and attained remarkable popularity in his practice. He held numerous public offices and figured rather as a statesman than as a physician. He acquired a large estate up the Hudson and became the intimate friend of Benjamin Franklin, to whom he first suggested the foundation of the American Philosophical Society. He left a large number of writings and correspondence with the most eminent savants all over the world. As the colonies steadily progressed in wealth and size, Charleston became more and more a prominent centre of influence, and here there lived and died during the century a group of five men, namely, Chalmers, Lining, Gardner, Moultrie and Barre, who made valuable contributions to science and achieved unusual distinction. All of these were of Scotch origin save the last, of whom it was claimed that he was the first person born in South Carolina, as well as the first native to receive a doctor’s degree. He was a pupil of Boerhaave, a graduate of Leyden in 1774. He gradually drifted into politics, as did Colden. Lining was perhaps the first American physiologist and published numerous papers in the Transactions of the Royal Society. He also published the first American account of yellow fever, which was the scourge of the century, and which appeared to spread to this country from the West Indies. Moultrie achieved an honorable position. He had a son who was also a doctor, and while both of them attained a high place in the esteem of their fellow-citizens, the death of the father was regarded as a public calamity, after some 40 years of phenomenal activity. Chalmers was the most active of all the others when he came to this country. He made himself generally known as a writer and developed power which would have made him, under suitable surroundings, a rare teacher. Gardner, like Colden, was a man of culture and fine education; in fact one of the most versatile men of his century in this country. He was a Fellow of the Royal Society. To these should be added, perhaps, John Mitchell, an Englishman by birth, who came to this country in 1705 and made a reputation which spread to the centres of learning in the old country. He published a number of essays in the Philosophical Transactions.}

A great event in the medical history of the 18th century was the foundation of the first hospital in this country. This must be duly credited to the energies of Benjamin Franklin, Dr. Thomas Bond and, later, Drs. Shippen and Morton. Bond was born in 1712, in Maryland. After studying for the ministry he went to Europe, whence he returned full of the idea of introducing the hospital system which had proved so advantageous abroad. Though he returned in 1734, not until 1751 were circumstances sufficiently propitious to found
SURGERY IN AMERICA

something more than a mere camp for the treatment of smallpox or a lazaretto for the care of sick seamen. Franklin threw the whole weight of his influence into this movement and finally £2,000 raised by private subscription, added to a similar sum contributed by the colonists, prepared the way for the opening of the Pennsylvania hospital in 1758. After four years of existence in rented quarters, the cornerstone of a new building for that purpose was laid, bearing an inscription suggested by Franklin himself. This institution had an enormous influence in more than one respect, since its foundation had made possible the creation of the first medical school in this country, which became a part of the University of Pennsylvania, and which owes its inception to the study and liberal enthusiasm of Morgan. Although Harvard College was founded in 1636 and Yale in 1701, it remained for this to become the pioneer medical school in the United States. Albany has a somewhat famous history regarding civil and military hospitals.

Previous to the American Revolution it had cared for many sick and wounded. Just before that period, in connection with the French and Indian wars, it had established a military hospital with accommodations for 500 patients. This was in use during the fighting along Lake Champlain, Lake George, Ticonderoga, Fort Edward, Bemis Heights, Saratoga, Schuyler-ville and the campaign of the Revolution. Later, during the epidemic of cholera, in 1832, barrels were erected in the streets; also in the beginning of the Civil War a large hospital was erected, much in the style of the barracks of to-day, and to this were brought the sick and wounded from about Richmond during the fighting under McClellan.

John Morgan began his study during the period of the French and Indian wars. As he came in contact with the foreign surgeons who came over with the English troops, he found his own ability not at all commensurate with his political bent. In 1760 he went to London and studied under the Hunters, and then to Edinburgh, where he came under the influence of Cullen, the Munroes and others, and where he graduated. He next went to Paris and returned to the United States in 1783. He then made a tour of Europe, having the advantage of a personal acquaintance with Morgagni in Padua. Morgan spent five years in his foreign study and upon his return, in 1765, became closely associated with the younger Shippen. The Shippens were a well-known medical family of Philadelphia, and were men of liberal education and social distinction. Shippen had already given private instruction in midwifery and the two men joined hands most heartily in this commendable effort. When the trustees of the college opened the school Morgan and Shippen became professors, respectively, of medicine and surgery. Thus it will be seen that Shippen was the first professor of surgery in this country, and that the first systematic instruction in surgery was given by him in 1765.

The faculty was joined a little later by Benjamin Rush, who became one of the most conspicuous figures of his day, as a professional man, in this country. He was but 24 years of age when he was made professor of chemistry, and he was but 31 years of age when he became a signer of the Declaration of Independence. The gathering war clouds of the Revolution dampened the ardor of all and the large number of men lying on the hospital and medical school was excessively heavy and fell mostly upon the shoulders of three or four men. In 1779 the assembly revoked its charter which was, however, restored in 1783. In this was put an end to the condition of affairs in New York was not much better.

One man, however, stood out pre-eminently as an efficient physician and broad-minded citizen. This was Samuel Bard, whose name deserves to be closely associated with that of Rush. When he returned to this country in 1765, after a period of foreign study, he was inspired with the thought of founding a medical school in his native land. In 1768 he associated with himself, Clossy in anatomy, John Jones in surgery, Middleton in physiology, Rush in chemistry, Tennent in obstetrics, he himself taking charge of the principles and practice of physic. Thus the medical school of King's College was established. This was perhaps the first in this country to distinguish himself as a surgeon. He had been under the best teachers in Europe, and had seen a great deal of military surgery in his day, especially during the French War. He was independent enough to decline to adopt some of the peculiar notions of his colleagues regarding appropriate costumes, but in the end the absurdities which he dispensed with were discontinued by them. He wrote a book for the Revolutionary surgeon, entitled 'Plain, Concise and Practical Remarks on the Treatment of Wounds and Fractures.'

Up to this time, midwifery had been practised by untrained women and it can readily be seen what an advantage it was to have the science of obstetrics systematically taught as it was in both schools above mentioned.

During the six years while New York was occupied by British troops there was a cessation of college activity. The faculty was not a unit in its political beliefs. The declaration of independence came dissensions. Three years after the war the college went on under its new name, Columbia, but with very poor success. A spurt was made again in 1792. In 1807 the New York University of Physic and Surgery was founded and the jealousy and strife prevented its success. Finally, in 1811, a union of the two schools was accomplished under the name of the younger and thereafter the College of Physicians and Surgeons prospered and is to-day one of the leading schools in this country, though again under the ægis of Columbia. Meantime under Bard's influence, the New York Hospital had been founded in 1768 and chartered in 1770. It was in their new building that the Provincial Congress used to meet during the second year of the Revolution; but when the British arrived the hospital was turned into a barracks and Bard and Jones joined the Continental army. A note in 1793 states that the hospital was fully and finally equipped and began its career of usefulness.

The Revolutionary Period.—At the time of our Revolutionary War the science of military surgery was not considered even with the Continental armies the barber-surgeon had a certain place, in which he was almost a menial, and above which he could scarcely raise himself. The English troops were better
equipped in this respect than were the Hessians, for instance, while during the latter part of the war, especially when the French sent some of their best men to this country, our raw and untrained army surgeons came in contact with a better class of men and by whom they were, to some extent, inspired. Nearly all of the prominent medical men, save the Tory physicians of Massachusetts, entered the army or took public service, and in the Massachusetts Provincial Congress of 1775 there were 22 physicians. Both the colonial and general governments dealt very stingily with their medical departments and the professional equipments provided were almost meager. The history of surgery in those days is mostly the history of a few prominent individuals who made it what it became and who deserve to be briefly mentioned. The brothers Joseph and John Warren took a very prominent part during the earlier portion of the war. It was the former who started Paul Revere on his famous ride. He was elected president of the Provincial Congress and just before the battle of Bunker Hill was made major-general of the Continental forces, preferring this office rather than the office of physician-general which he had been offered. He was a man of wonderful spirit of self-sacrifice and, declining his rank, acted as a private, and with musket in hand fought nobly, and was shot dead just at the conclusion of the battle. The younger brother, John Warren, lived to achieve fame and reputation, and transmitted them to a posterity by whom they have been well preserved. He constituted a brilliant contrast to many of the regimental surgeons who had been too often appointed by political influence without regard to attainment. Some regiments were even organized without a surgeon and came into camp without the slightest provision for disease or injury. In 1776 Congress enacted that there should be one surgeon and five assistants to each 5,000 enlisted men. The former was to be paid $1.66 per day and the latter each $1 a day. The reader can imagine the care 5,000 men would receive from six physicians whose services were compensated at this rate. At that time such a hospital was almost unknown and a hospital corps and ambulance drill were quite lacking. But John Warren, then but 23 years old, proved extremely efficient in the organization and completion of, and accomplished a great deal for the improvement of his department. The first surgeon-general of the Continental armies was Benjamin Church, of Boston, who was given the title of director-general and chief physician and was paid $4 per day. Church gave promise of efficiency in his department, but before long was detected in correspondence with the enemy, for which he was court-martialed, imprisoned for one year and allowed to leave the country and probably lost at sea. His place was taken by John Morgan of Philadelphia, already mentioned above. He had the politicians to fight and after a long and arduous struggle, failing to satisfy them, he was dismissed service, although he was finally acquitted of all blame. This was a time of unrest, excitement and suspicion and had Washington himself been a weaker man, he could scarcely have withstood the dissensions and jealousy with which he was continually surrounded. Morgan was succeeded by Shippen, his old associate, who remained in office from 1777 to 1781. Under his guidance the medical department almost prospered and was at least conducted with dignity and great benefit to all concerned. And smallpox, which had been the scourge of the soldiers as well as the people in general, was kept down by the practice of inoculation, which had been generally accepted by nearly all men from Washington down.

From the Revolution to the Civil War.—The most conspicuous monument of American medicine, which practically began with the conclusion of the Revolutionary War, was Benjamin Rush, of Philadelphia (1745-1813), an exceedingly versatile, many-sided, erudite, obstinate, skeptical man, constant only to his religion which he considered to be a professional duty. He was hated by many of those to whom his methods most strongly appealed. He had rare didactic gifts, but his teachings were abused by his students and followers. As a young man he had traveled in Europe and had taken his degree at Edinburg. He had come especially under the influence of Cullen, whose views he had imbibed and later accepted in a modified form. He served two terms in Congress, where the duties of a wonderful spirit of self-sacrifice and, declining his rank, acted as a private, and with musket in hand fought nobly, and was shot dead just at the conclusion of the battle. The younger brother, John Warren, lived to achieve fame and reputation, and transmitted them to a posterity by whom they have been well preserved. He constituted a brilliant contrast to many of the regimental surgeons who had been too often appointed by political influence without regard to attainment. Some regiments were even organized without a surgeon and came into camp without the slightest provision for disease or injury. In 1776 Congress enacted that there should be one surgeon and five assistants to each 5,000 enlisted men. The former was to be paid $1.66 per day and the latter each $1 a day. The reader can imagine the care 5,000 men would receive from six physicians whose services were compensated at this rate. At that time such a hospital was almost unknown and a hospital corps and ambulance drill were quite lacking. But John Warren, then but 23 years old, proved extremely efficient in the organization and completion of, and accomplished a great deal for the improvement of his department. The first surgeon-general of the Continental armies was Benjamin Church, of Boston, who was given the title of director-general and chief physician and was paid $4 per day. Church gave promise of efficiency in his department, but before long was detected in correspondence with the enemy, for which he was court-martialed, imprisoned for one year and allowed to leave the country and probably lost at sea. His place was taken by John Morgan of Philadelphia, already mentioned above. He had the politicians to fight and after a long and arduous struggle, failing to satisfy them, he was dismissed service, although he was finally acquitted of all blame. This was a time of unrest, excitement and suspicion and had Washington himself been a weaker man, he could scarcely have withstood the dissensions and jealousy with which he was continually surrounded. Morgan was succeeded by Shippen, his old associate, who remained in office from 1777 to 1781. Under his guidance the medical department almost prospered and was at least conducted with dignity and great benefit to all concerned. And smallpox, which had been the scourge of the soldiers as well as the people in general, was kept down by the practice of inoculation, which had been generally accepted by nearly all men from Washington down.

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of the times. The great benefit of the Revolution came from the presence of the educated and learned men, both at home and abroad, who came to the country and brought their books and wisdom with them.

The greatest figure in American surgery during the earlier part of the previous century was Philip Syng Physick. He was born in 1758 and died in 1837. He came of a good family and had a good education. But it was not until 1789, when, in London, he had the good fortune to be taken into the family of John Hunter, that he developed those qualities which helped to make him great in after life. Had he been willing to remain in the old country he might have become Hunter's partner. He had the best that the old country could afford, spending some 11 years in study, all told, which was a remarkably good preparation for practice 100 years ago. He yielded to the claims of his native land and quickly built up a practice after his return to this country. He had much with which to contend, including indigestion, an absolute lack of humor, in fact a temperament such as to make him unpopular, the only thing that saved him from his being his brains. In spite of all this he left behind him the reputation of being the Father of American Surgery. One of his most celebrated cases was that of Chief Justice Marshall, from whose bladder he removed an astonishing number of calculi. In 1805 he became professor of surgery in the University of Pennsylvania, which chair he held for 37 years. Though classy and uncouth in person he was singularly dexterous with his hands, and excelled in deftness with the knife, and with all forms of orthopedic apparatus. He gained great reputation in his treatment of fractures and dislocations, many modifications of which he made which proved very advantageous. For some years he had promise of a successor in his nephew, John Dorsey, who, however, died before his uncle, and never lived out his promised career.

The first prominent American surgeon was Ephraim McDowell, who came from what was then called the "Far West," in Kentucky. When young he went to a classical seminary, where he got a smattering of Greek and Latin, but not much else. He made his practice until he was 20. He began reading medicine in Danville, Ky., but was finally sent to Edinburgh by his father. Here he came under the influence of John Bell, whose teachings made him what he became. He returned in 1795 and decided that there was a rare opportunity in Kentucky for an educated physician, in which matter his foresight proved correct. In 1809, when he undertook the first and great historical 'Ovariotomy,' he was already known as an accomplished and educated man, upon whose mind the teachings of John Bell had made a great impression. When Mrs. Crawford came to him, suffering from an ovarian cyst, he was ready to undertake her case despite the protests of others. The case took 23 hours, with no gas and no ether. He bravely, and it was not until he had performed a number of similar operations that he thought it best to publish anything on the subject. Even then his paper did not see the light as it should, and then he died. It was a great thing, however, for those who should have known better as to whether his report was really authentic and whether he should be credited with this pathetic finding expedient. He has been amply vindicated, however, and this fortunate experience of his paved the way for many operations but for whose effects thousands of lives would have been sacrificed.

The next great figure was Valentine Mott. He was born in 1785, and was of Quaker parentage. He was a great classical student, and was well equipped for professional study when he began to study medicine. He then spent two years in Great Britain, especially in London, which was then rich in famous surgeons. Under Hunter, Cooper, Abernethy and Charles Bell he acquired that familiarity with surgical anatomy which was a great help both then and in later years. He returned to New York in 1809, and his personal traits as well as his thoroughness quickly brought him practice and made him known. He became the teacher of surgery in the Columbia School until he transferred his activities to the new school which resulted from the union of Columbia and the College of Physicians and Surgeons, where he lectured for 58 years. He was a man of constant enthusiasm and eagerness for work. The influence of his insistence upon the importance of anatomy still persists, and was brilliantly demonstrated by his work upon the blood vessels. It is said that he tied more large vessels than any other surgeon living or dead. Perhaps his greatest achievement, at least the one that made him most famous, was ligature of the innominate artery. This first operation of its kind was not permanently successful, nevertheless it stamped the operator as a man of wonderful resource and daring. The first successful case belongs to another American surgeon, A. W. Smythe, of New Orleans, who tied at the same time, the carotid artery in the neck. Again he won great repute by removing the entire clavicle for a large tumor. In 1827 he tied for the first time, successfully, the common iliac artery. The previous operation had been made by another brilliant American surgeon, Gibson, of Baltimore, whose patient unfortunately died of peritonitis. In 1835, quite broken in health, he made a tour of Europe, which had about it much of a triumph, insomuch as he was everywhere received with éclat.

We have also mentioned how, in 1778, John Warren served in the Revolution both as a surgeon and patriot. His son, John Collins Warren, was born in 1778, and was reared in an atmosphere of study and refinement. He was thoroughly educated for his work, in which he took the greatest pride, and, like Mott, had the advantage of the teachings and friendship of the most distinguished foreign surgeons. Two events of importance, in which he was conspicuous, were the founding of the Massachusetts General Hospital, and the introduction into surgery of the then new anesthetic, sulphuric ether, of which we shall have more to say below. He was a bold operator and for his operations on bones, especially the jaws, he became famous. He published the way for professional study of his personal cases in his "Surgical Observations on Tumors," which are to-day most instructive. He was the founder of the large collection of specimens now known as the Warren Museum, in Boston.

While Warren and Mott were making their great reputations in the East, it remained for Kentucky to produce still another even greater
than McDowell, in the person of Benjamin Winslow Dudley, born in 1785, who began life in an obscure way and who raised himself to eminence purely through his own attributes and strength of character. While quite young he made enough money, by a shrewd enterprise, to take him abroad where he remained several years, returning a polished and educated gentleman. Cooper and Aitkenhead in London, and Larrey in Paris, were men for whom he had much admiration and with whom he became well acquainted. When he returned he was 29 years of age, matured and devoted to his science. As a measure of his success it may be said that in his first 100 cases of cutting for stone in the bladder he lost not one; a statement that could be made by but few surgeons to-day. His early work in the surgical treatment of epilepsy directed attention to what could be done in this almost hopeless disease, and his treatment for hydrocele by excision of the sac is in common use to-day. For 20 years he was prominent in the Transylvania Medical School, in Lexington, Ky., which was largely managed by the College of Louisville. Dudley wrote very little, but his personal influence was extraordinary, and he was without doubt the leading practitioner of the West. He died in 1870.

In the interest of economy in space, it will be best, perhaps, to recount the various historical achievements of American surgeons without going into further biographical details. In the department of surgery of the large blood vessels the American surgeons were almost pioneers. In 1803 Cogswell of Hartford tied the common carotid, making the first successful ligation of this vessel on record. In 1807 it was first successfully tied for secondary hemorrhage by Twitchell of Keene, thus annulling Ashley Cooper's famous case by eight months. In 1813 Leet of New York first tied this artery for the cure of aneurism. In 1823 MacGill of Maryland first successfully tied both carotids simultaneously, the case being one of fungus tumor in both orbits. In 1867 Carneohan of New York first tied both carotids for the treatment of aneurism of the face and neck. Post, in 1817, first tied successfully the subclavian artery in its third portion, after it had failed in the hands of some of the great English surgeons. The same artery was first tied in its first portion by Rodgers of New York, an operation hitherto considered impossible, and which was never successfully repeated until 1892, by Halsted, of Baltimore. Mott's first ligation of three innominates artery has already been mentioned, an operation which made him famous all over the world. The internal iliac was first tied by Stevens in 1812, the external by Dorsey in 1811, and both internal and external by Dennis in 1866, while Davidge first tied the femoral and gluteal for the cure of elephantiasis of the lower extremity. Digital compression for the relief of aneurism was first successfully practised by Pemberton in 1848. The use of the elastic bandage in the treatment of varicose veins was first successfully adopted by Martin of Boston, who preceded Esthack in the use of this expedient for controlling blood supply during amputations; while Wyeth recently introduced long pins for the same purpose in amputation of the shoulder and hip.

In fractures and treatment of injuries and diseases of bones and joints, Physick exceeded all men, without question. The so-called American method, which is now so widely accepted, that is, the treatment of fractures by traction with a weight and pulley, was introduced by Daniel of Georgia. Van Ingen of Schenectady added to the method the elevation of the foot of the bed, and Buck increased its value by his application of splints. The present universal method is, therefore, a composite of all these, but is distinctly American. So is also the use of elastic traction by the aid of rubber bands. Barton, Bond, Hamilton and Reid, the latter of Rochester, all studied assiduously the mechanism of fractures and dislocations, and described the methods for their treatment and relief. The interdental splint for the treatment of fractured jaw was also of distinctly American origin. Rodgers introduced metallic sutures in the treatment of fractures; Brannam of Chicago, the method of drilling fragments in delayed union, while both Henry Smith of Philadelphia and Nathan Smith of New Haven did very much to improve apparatus for the retention of fragments in their proper places.

In the treatment of dislocations, especially in the matter of their reduction by manipulation, the world owes a great deal to Reid and Moore of Rochester, Bigelow of Boston and Gunn of Chicago, by whose efforts it was brought about that the ponderous machinery of the clinics was completely abandoned. In the removal of diseased bones Jamieson of Baltimore, in 1820, made the first resection of the upper jaw, while the upper and lower jaws were both simultaneously removed by Rodgers of New York. The first removal of the lower jaw was by Deaderick of Tennessee in 1810, while the clavicle was first successfully removed for necrosis by McCreary of Kentucky, in 1803, and for malignant disease by Mott in 1828, and the entire upper extremity, including the scapula and clavicle, by Crosby in 1836, and again the entire radius in the same year. Stone first removed a rib for drainage in 1852, and Mott the coccyx in 1832. Wood of New York had a famous case of enucleation of the lower jaw with almost complete reproduction of bone. Other operations of importance on bones were the first removal of a V-shaped piece of the hip, and also for the cure of bony ankylosis of the lower jaw. Nathan Smith of New Haven is entitled to the credit usually given Brodie for the trephining of inflamed bones for the relief of inflammation and abscesses.

In the matter of amputation Richard Bailey is to be credited with the first systematic amputation of the shoulder joint, in 1762. Crosby's case of the removal of the entire extremity has already been mentioned. The first successful amputation of the hip was made by Brash of Kentucky in 1806. The patient was a slave boy bought by the colonel of St. Joseph's College. The first operation of this kind ever done was in England by Kerr in 1774; while the first done for gunshot wound was by Larrey in 1793. American surgeons also made many improvements in gynecological surgery. The first successful plastic operation for extre-
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The py of the bladder was made by Pancost of Philadelphia in 1858. He and others preceded Wood and various English surgeons to whom the credit is usually given. Parker of New York introduced cystotomy for the relief of chronic cystitis. The kidney was removed successfully by Wolcott and by Stoddard of Milwaukee nine years before it was removed by Simon of Heidelberg, who has been credited with it. The first really successful method of operation for cleft palate was introduced by J.C. Warren of Boston, while Cheever, another Boston surgeon, was the first to remove the tonsils by external incision.

In abdominal surgery Americans have almost led the world. Had it not been for McDowell's epoch-making case, in 1809, this branch of surgery would have been much retarded. Any one practising to-day can scarcely realize the moral courage and surgical daring required during that historical incident. Atlee of Philadelphia and Kimball of Lowell were the first to remove the bladder stones by cystotomy. It is claimed that Stevens of South Carolina, as early as 1763, successfully removed the entire uterus, an operation repeated by Briggs in 1830. The first vaginal operation for extra-uterine pregnancy was made by King of South Carolina in 1813, while the abdomen was first opened for this purpose by John Baird as early as 1759. Bobbs of Indianapolis was the first to attack the gall-bladder surgically, while Willard Parker first made clear the surgical treatment of peri-appendical, or as it was then called, perityphilitic abscess. The entire elucidation of the surgery and pathology of appendicitis is due to Americans, especially to Fitz and McBurney. The treatment of gunshot wounds of the abdomen by abdominal section was conceived, developed and perfected in America, especially by Bull and Parkes, while Sen, Murphy and others have made valuable contributions. The first four cases of pancreatic cyst were in the hands of American surgeons. The surgery of the female genital organs was close to the ingenuity and skill of Americans than to those of all other nationalities combined. Especially valuable in this direction were the labors of Sims and Emmet. Other procedures of modern surgery might be named without making the list too long; for instance, the invention of skin grafting by Dr. Frank Hamilton of Buffalo in 1854. The same procedure was independently instituted by Reverdin of Geneva, Switzerland, each being independent of the other. Animal ligatures were first used by Physick in 1844. The innocent character of the metallic ligature, as well as its usefulness, was first demonstrated by Levery, of Mobile. The use of plaster-of-paris splints and jackets was greatly promoted by Sayre of New York, although he was not their originator. The first abdominal section for gunshot wound of the intestines was made by Kinloch of Charleston in 1851. The discoveries and inventions of American orthopedic surgeons have been models for the rest of the world.

The two great events in the history of American surgery in the 19th century were the introduction of anesthesia and the antiseptic technique. Both stand to the credit of the American race, the former being an American invention, the latter a British device. These two measures together wrought a complete revolution in the practice of surgery, and show that the Anglo-Saxons have done more for it than had been accomplished in the previous 18 centuries. By the latter the devastations of sepsis have been almost completely done away with; and by the former the tortures of pain and the agonies of serious and protracted operations have been abolished.

Period of the Civil War.—The exigencies of the Civil War made demands upon the medical resources of the regular and volunteer armies which at first could not be adequately met; in this as well as other respects both sides were but meagrely equipped either with men or means. It was before the days of antisepctic surgery, bad methods still prevailed and the sacrifices then made to sepsis and to bad sanitation were fearful to contemplate. Wounds of large joints condemned the patient to amputation above the injury, compound fractures were very generally, fatal, hospital gangrene and tetanus were like aspera uterine fibroids, and it is claimed that Stevens of South Carolina, as early as 1763, successfully removed the entire uterus, an operation repeated by Briggs in 1830. The first vaginal operation for extra-uterine pregnancy was made by King of South Carolina in 1813, while the abdomen was first opened for this purpose by John Baird as early as 1759. Bobbs of Indianapolis was the first to attack the gall-bladder surgically, while Willard Parker first made clear the surgical treatment of peri-appendical, or as it was then called, perityphilitic abscess. The entire elucidation of the surgery and pathology of appendicitis is due to Americans, especially to Fitz and McBurney. The treatment of gunshot wounds of the abdomen by abdominal section was conceived, developed and perfected in America, especially by Bull and Parkes, while Sen, Murphy and others have made valuable contributions. The first four cases of pancreatic cyst were in the hands of American surgeons. The surgery of the female genital organs was close to the ingenuity and skill of Americans than to those of all other nationalities combined. Especially valuable in this direction were the labors of Sims and Emmet. Other procedures of modern surgery might be named without making the list too long; for instance, the invention of skin grafting by Dr. Frank Hamilton of Buffalo in 1854. The same procedure was independently instituted by Reverdin of Geneva, Switzerland, each being independent of the other. Animal ligatures were first used by Physick in 1844. The innocent character of the metallic ligature, as well as its usefulness, was first demonstrated by Levery, of Mobile. The use of plaster-of-paris splints and jackets was greatly promoted by Sayre of New York, although he was not their originator. The first abdominal section for gunshot wound of the intestines was made by Kinloch of Charleston in 1851. The discoveries and inventions of American orthopedic surgeons have been models for the rest of the world.

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at that time were termed, abdominal surgeons. The outcome has been the organization of several national surgical associations, which have included in their fellowship some of the ablest of their breed, in the United States, thus enabling America to keep thoroughly abreast of all that was being done elsewhere. There has been a progressive development of bacteriological, biological and pathological laboratories where much research work has been accomplished, aiding very decidedly in the better understanding of surgical lesions, and resulting in a great increase in the possible operations to be performed for relief of the patient.

Hod the elder Gross, in his early experiments, in 1843, known of or had a laboratory at his disposal, such as exists to-day, greater honors would have come to him in doing intestinal surgery.

Laboratory work, with increased surgical skill, has brought about the establishment of many hospitals in the larger and smaller cities, and it may safely be asserted that in the latter many strong surgeons in the World War just brought to an end will be found doing superior work, the incentive will feel the good impulse of benevolence, excellent nursing and support from Red Cross organizations, while the larger hospitals in cities will become better endowed and less embarrassed in meeting their financial obligations.

It is very impressive to note how willingly communities have accepted going from their homes to the hospitals for treatment. Research work has brought out many surgical conditions associated with illnesses heretofore considered medical, such as lesions of the bones following typhoid fever, also tubercular conditions of the joints, syphilis, actinomycosis and other obscure lesions of internal organs, this advance being conducive to recoveries of cases formerly doomed to a long, painful sickness. Our laboratories have been of incalculable value in the preparation and standardization of absorbable ligatures; in the examination of the blood, and various secretions, and, especially, in the development of tetanus, antitoxin and other serums.

One great advance made by American surgeons has been the surgical treatment of the thyroid gland; another the energetic manner in which they have attacked the gall-bladder, the stomach, the intestinal tract, the spleen, pancreas and the reproductive organs within the pelvis, for conditions considered quite hopeless in the past. Operations upon the appendix, and intestinal tract, with the ability to remove portions of the latter, yet allow normal functions to follow in a healthy manner seem wonderful. This same confident development of surgical procedure has eliminated much of the distress due to lesions of the kidneys, the ureters, the bladder and prostate gland. All of this work could not have been accomplished without our knowledge of pathological microorganisms, and the employment of sterilization of the operating-room, the field of operation, the operator and dressings.

American surgeons had much to do with the prohibition of antisepsis, much has been accomplished. The battle has been to control suppuration,—i.e., the formation of pus,—and when every precaution has been carried out, when no link in the chain of infection has been omitted, to the public at large the recovery of patients becomes very noticeable.

In successful work surgery made a stride that commanded the respect and attention of wealthy citizens with a benevolent trend of thought, so that hospitals and laboratories were endowed, and in America we were able to do what for some time seemed only to be known in Europe.

Through the study of germs, in the various laboratories, and their danger to operative surgery, and with the employment of absorbable ligatures, the science and art of surgery has been brought up to a very high plane of activity. The advances made in operations upon the spine, and the treatment of curvatures from the long bones of the body, for the treatment of curvatures, has been one of the most decided advances in surgery. This is also to be observed in the immobilization of wounds, and in the fixation of fractures of the extremities.

Very much credit is due the American surgeon for discoveries and advances in local anesthesia in operative surgery, in hospital construction and for the persistent use of rubber gloves, particularly when operating in septic cases.

Some of the most brilliant advances made in surgery of the nerve trunks, in the removal of the Gasserian ganglia, for relief of neuralgia, had been accomplished by the American surgeon. The investigation, study and progress made in the department of genito-urinary surgery is one of the most convincing arguments that surgery has become more of a fixed science than ever in its past history.

The genius of the American surgeon is well shown, in so many ways, by the invention of new instruments, as well as the improvements made in those long in use, and in hospital furniture.

History of Anesthetics.—The abolition of pain is in itself a matter of such vast interest and humanitarian importance that a brief history of the introduction of anesthetics should be much appreciated, especially in a rehearsal of American achievements. Strictly speaking, the term anesthesia refers to the abolition of sensation of all kinds, whereas for the prevention of pain the term analgesia should be used. The distinction is an important one in certain cases; for instance in the injection of cocaine solution into the spinal canal, it produces the latter without the former, whereas by the use of the anesthetics now in use general anesthesia is produced. By general consent the term is restricted to complete loss of consciousness produced by such drugs as ether, chloroform and nitrous oxide, and not to the intoxication produced by drugs like opium, hashish or the mandragora of the old writers. The substance known as sulphuric ether had been known by the medieval alchemists in 1540, and was spoken of as sweet oil or vitriol oil. It was not called ether until 1730. In the earlier years of the previous century it was often inhaled for experiment or diversion because of its peculiar
exhilarant effects. Nitrous oxide gas had been previously used for the same purpose, and even for the production of anæsthesia. It will be seen, then, that these two anæsthetics had been well known for some of their properties. Chloroform, on the other hand, was not discovered until 1831, and was recommended as an anæsthetic until 1847. The honor of the introduction of ether into surgery is claimed for at least four men: Long, of Georgia; Jackson of Massachusetts, who were physicians; Wells, of Vermont, and Morton, of Massachusetts, who were both dentists. The first public demonstration of the value of ether as an anæsthetic agent, for the prevention of pain during surgical operations, was made 16 Oct. 1846 by Morton, at the Massachusetts General Hospital, before a group of men including some of those already mentioned in this article, especially Warren and Bigelow. In all probability Long anticipated this event by its use for a similar purpose in 1842, but in those days in this country the population was sparse, means of travel very slow and made public record of the event was ever made; in fact no account of Long's work appeared until 1849. To Wells probably belongs the credit of first producing anæsthesia by nitrous oxide gas, when he took it himself in 1844. After his own happy experience with it he began its manufacture and introduction to the profession. In 1845 Wells visited Boston, and even called on his old partner, Morton, endeavoring there to introduce his new compound for surgical purposes, but met with no encouragement. In Hartford there stands to-day a monument erected by the public, bearing the following inscription: Horace Wells, who discovered anæsthesia, November 1844. Morton had been a student in Wells' office, but not being a good chemist he consulted Jackson, whose office he later entered, and by whom he was advised to experiment with ether. Jackson told him, for instance, that the students at Cambridge often inhaled it for amusement, and in 1846 he first gave it for the extraction of a tooth, the patient thinking that he felt no pain. Then came efforts to patent the new anæsthetic which were not to the credit of either Jackson or Morton. Finally came the public demonstration above alluded to, when Morton administered his ether, which Wells removed without pain a tumor from the neck of a young man. At this time Morton endeavored to disguise the odor of the substance he was using so as to prevent its recognition, and it was not until the hospital staff declined to use any substance whose composition was kept secret that Morton revealed his discovery. During the ensuing years there took place a most active and acrid controversy between the partisans of the men most concerned in the introduction of ether into surgical work, as to the respective merits of their various champions. A dispassionate judgment of the whole indicates that to Wells, doubtless, the credit of the introduction of nitrous oxide belongs. Long probably was the first to use ether in a surgical way, but was slow in pushing the use of his discovery. Morton finally became the promoter of the new agent, partly by virtue of his own energy and partly because of his acquaintances and surroundings. Chloroform, although discovered independently by Guthrie, of Sacketts Harbor, N. Y., in 1831, was introduced into surgical work by Simpson, of Edinburgh, who advised it especially for the relief of the pangs of childbirth, and who was, in consequence, violently assailed by the Scottish clergy as interfering with the spirit of the primal curse which read: *In sorrow shall thou bring forth children.* Simpson, however, disarmed his opponents by a quotation, also from the Scriptures, to the effect that when God created Eve from one of Adam's ribs, he *caused a deep sleep to fall upon Adam.* It will hence be seen that, at the date of this writing, it is almost 70 years since it became possible to make surgical operations painlessly. What this means both for the surgeon and the patient will be appreciated, while what it has made possible can be easily realized by contrasting the resources of the surgeon of to-day with those of the middle of the 19th century. See Visitation — Its Influence on Surgery.

ROSEWELL PARK,
Author of 'Text Book of Surgery,'
ALBERT VAN DER VEER,
Professor of Surgery, Albany Medical College,
1878-1915.

Surgical Association, American, a society organized in 1880, the objects of which are to promote the improvement of the science and art of surgery. The active membership is limited to 125 Fellows and the honorary membership to 25 Fellows. An applicant for Fellowship must be 30 years of age, a graduate of five years' standing from a recognized medical college and have an established reputation as practitioner, author or investigator. Meetings are held annually and an annual volume of Transactions is published. Every third year the association joins with other associations constituting the Congress of American Physicians and Surgeons in a meeting held in Washington, D. C.

Suricate, or Meerkat, a South African civet (Suricata tridactyla), which differs from typical viverrines in several points, notably in having only four toes on each foot. It is dark brown and has dark transverse stripes on the rear of its back. The body and head reach a length of 12 or 13 inches, the tail 6 inches and the animal has a general resemblance to a small raccoon, but the tail is more cat-like. It lives in caves and rock-cavens or sometimes digs burrows. It is diurnal, lives mainly on roots and barks like a dog. Consult Martin, 'Home Life on an Ostrich Farm' (New York 1903).

Surigao, soo'o-ré-ga'oo, Philippines, (1) Town, capital of the province of Surigao, Mindanao, on the extreme north coast of the island of Mindanao. This district was the site of the first Spanish mission in the Philippines; in 1579 a series of earthquakes caused the ground in the neighborhood of the town to sink two feet and many of the government buildings were rendered uninhabitable for a time. The chief industries are the gathering and export of pearl shells and tarpag and the placer mining of gold. Pop. 7,749.

(2) Province, island of Mindanao, occupying the northeastern part of the island; area, 6,988 square miles. The principal dependent island is Dinagat, lying off the north coast;
it is mountainous, heavily wooded and has deposits of gold; area, 387 square miles; the second island in importance is Siargao (q.v.), 190 square miles. The province is traversed by two mountain ranges, extending from north to south, one near the east coast, the other forming the western boundary; spurs of these ranges extend in both directions. The central valley is drained by the Agusan River, entering the Pacific Ocean in the Philippines. Cotton, hemp, rice, sugar, tobacco, indigo, etc., are cultivated; the coconut, betel nut and betel pepper are grown for export. Gold is found in the mountains and in the sands of the mountain streams and is mined; the forests are valuable, and gums and resins are obtained in large quantities; fishing is an important industry, and there is some weaving of native fabrics for home use. There are few roads, the communication is by sea or by the rivers and lakes of the central valley. Civil government was established in the province in May 1901, but the jurisdiction of the provincial government does not extend to the non-Christian tribes. Pop. 11,551.

SURIGAO. Strait of, connecting the Sulphur Sea with the Pacific, having Mindanao on the south and the islands of Leyte, Panaon, Bohol, Cebu, Negros and Samar on the north. It was the route taken by Magellan after crossing the Pacific. The San Bernardino Strait is now used more than Surigao during certain seasons, but Surigao is the more direct, deeper thoroughfare and the more advantageous route for vessels bound for the southern Philippines.

SURINAM, soo-rë-nëm'. See Guiana.

SURINAM TOAD, or PIPA TOAD, a toad of the South American family Pipidae; specifically Pipsa americana. It is one of the largest and the most repulsive-looking of the toads and is noted for its extraordinary mode of developing the eggs and young: When the female is about to expel her eggs the male mounts upon her back and the eggs as they are extruded are squeezed upward between the back of the female and the belly of the male, while they stick to her skin and gradually sink into the spongy skin, each occupying a pit with a lid. Fertilization takes place by some process not well understood just before the extrusion of the ova. The eggs remain in the pits until they have reached a mature condition (although, yet very small) and then escape into the water. Consult Gadow, 'Amphibia and Reptiles' (New York 1901).

SURMULLET. See Mullet.

SURNAMES. A surname is a name added to a baptismal or Christian name which makes it more specific, and is generally a family designation. It may be indicative of descent, habitat, occupation, craft, or may have originated in totemistic associations, clanship, personal peculiarities or from vulgar nicknames. A proper name, once given or adopted, becomes in time a part of the individuality. The giving of names is not necessarily proof of an advanced civilized condition. It may be considered coeval with and intimately connected with the gift of speech; the Adamic tradition of the origin of common names is a sate than presupposed to preclude Adamic savagery. The primal family grew into the primal tribe, and proper names became necessary; the land and the gathering of men upon it necessitated proper designations for each, or the same name for both.

All proper the grandparent, at first, a peculiarly appropriate meaning, which in time often becomes obscured and ultimately forgotten. Schlegel traced descriptive epithets in almost all Hindu names, and the older names among the Hebrews, Arabs, in fact all Oriental nations, are highly significant and personal as "son of wool," "son of wealth," "son of the scythe," "young of dog," "prince of the dogs" among the Tcherkessians of Mount Caucasus. This is measurable true of names of Aryan origin, and noticeably those of Teutonic and Scandinavian lines. The North American native is usually named from some animal, for totemic reasons, and later earns another from some deed of daring performed; and similar practices prevail in all savage tribes. In fact, the origin of heraldry may be looked for in totemic devices and symbols.

The study of proper names is useful in historical and literary researches—as important as numismatics, heraldry, superstition, symbolism and tradition. The name of a man often retains the impress of his country, and sometimes of the period in which he lived, and may thus furnish a clue to correct a date or vague notion, or to settle a disputed question in chronology, geography or genealogy; the conquerors of Andalusia, the Vandals, gave their name to that province, and it is hence not derived from Andalus, son of Japhet and grandson of Noah; the posterity of one man cannot, in reason, cover 30 degrees of longitude, in three generations, in a barbaric age.

In Rome, family or clan names were hereditary, but surnames remained individual, sanctioned by public consent, as Scipio Nasica, Piso Frugi, Lentulus Sura. In the republics of Greece, notably Athens and Sparta, men's names were significant of the power, valor, virtues or victories of the people, as Agesilaus, Charidemus, Demagorus, Demophilus, Demosthenes, Laodiece. In fact it is common among all peoples to exaggerate the importance of the significance of names. Both Greeks and Romans augured well or ill from them. Grecian names are significant, either of religious feeling, the remembrance of great events, some happy omen, chance, friendship or gratitude. Daughters were named from their fathers more scrupulously than were the sons; Homer uses their names in this wise without exception, as Chryseis, the daughter of Chryses; Briseis, the daughter of Briseus. The son's name was frequently an enlarged form of the father's, as it was deemed that polysyllabic names were more honorable than shorter ones, which were given to slaves: the Spartan Hegesander named his son Hesander, tyrant of Syracuse, named his son Hieronymus. There are traces of a desire to adopt family names, among the Greeks, but it generally ended in a vague reference to the hero from whom the family sprung; these are names which were only adopted by those families who pretended to trace back to deities or fabulous periods of history.

The Scandinavians and largely the Germans had none but individual names; every family, as with the Greeks, showed a decided preference for certain names, and these were generally transmitted from grandfather to grandson,
or from uncle to nephew, for some occult reason, while the daughter was only known by her father's name (as All-hide meaning literally the child of All's). Others retained the root from which the head of the family derived his name, but varying the syllable of this; the three sons of the formidable Argrim retained the last syllable which signified rage). There were thus no family names among the Celts, strictly speaking. The songs of the Druids have perished, with the names of the heroes that sang of; but more fortunate were the heroes of Erin and Morven, for the ancient national songs still exist in Ireland and Scotland.

The need of surnames began to be felt. Many would naturally prove themselves "dreadful-in-the-fight," "Hardy," "Stern-of-look," and the Northern nations soon adopted a method of adding the father's name to the son's; as Oscar son of Ossian, Oscar son of Caruth, Dermid son of Dutho, Dermid son of Diaran. The introduction of Christianity, which taught the equality of man, breaking up class distinctions, rapidly advanced the adoption of surnames by the use of new or baptismal names — Biblical or saints' names, anything but pagan cognomina, much caused trouble; the new names were almost wholly derived from foreign languages, and as such had no local or personal significance.

The rise of feudal power was another source of change and confusion, as retainers or feepees often bore the name of their overlord, whose title might arise from his office at court or his most valuable estate. The division of estates led to a new distribution of surnames among the heirs, taken from the inherited estates, only the oldest retaining the father's name by reason of the name being attached to the home-estate. The charters of the 10th and 11th centuries often recited the same individual under different names — sometimes because he had lost the manor which gave him title, or had come into possession of another which was more flattering to his vanity. The law of primogeniture finally cleared away much confusion, the property becoming settled in tenure and the owner dealing with his paternal property; from that time a surname was rarely lost and was further confirmed by the granting of armorial bearings.

In heraldry we find many surnames derived from "canting arms," which clearly proceeded from the arms; as in Sweden, the family whose arms represented the head of an ox took the name Oxenstierm (like the well-known Front-de-Boeuf); the Racines had originally placed in their coat-of-arms a rat and a swan (Nat-Gyne), but the writer of "Athletic" retained only the swan, as the rat offended his taste.

To England the Saxons brought their feudal institutions; immense properties were attached to the land, and the Thanes, and then formed out to substantial tenants who again let them to subtenants for cultivation. William the Conqueror redistributed these lands as fiefs among his Norman warriors; Henry I, a 1100 changed the fief tenure into real or frehold property, but his concession produced to great increase of hereditary names. In 1160 Henry II enfranchised the land in order to counteract the ambitious barons; soon after his time hereditary names became common in England.

It appears that surnames began to be adopted in England about 1000 A.D., coming mainly from Normandy. A few Saxons had surnames: "Hwita Haite was a keeper of bees in Northfelda, and Tate Haite, his daughter, was the mother of Wulfige, the squire. In the Cottonian manuscript shows a transition point. In the time of Edward the Confessor there were Saxon tenants in Suffolk: Leuristic Hobbesone (Hobson), Suert Magno or Manni, Godric Point, Suert Robert of Red Ruth (redhead) and Stigand Soror. In the Domesday Survey they were becoming more common: as Alwin Dodesone (Dodon), Walter Achet, Osmund Anglevin, Roger Arundel, Walter Bc, William Bonvaslet; some of these being curious Norman blends of their own names with those of their Norman masters, as above in Arundel and Anglevin. When King Magnus assumed Highland dress he became known as Berbein (Breveleg), still preserved, probably, in the Puritan "Barebones."

The terminations "ing, kin, son, in English names, were derived from the Norse "ingr, kyn and sonr, the being dropped. The Danish make the last sen. The diminutives: Friesian, "etten, ke, ock, eck (a lasting folk), Scotch "gowkies"; Norman-French et, ette, let, ot, otte, et; Old Norse, i, a, ki, go, ga, ungr, ingr and lind, became quite common additions to English names, which have since adhered.

The Gaelic Mac, Irish O, the British Ap, the Norse ungar, the Friesian ingar and en, the Anglo-Saxon ingr, the Norman Fitz (probably from Flanders originally; many Irish families substituted Fitz for Mac in Norman times) are all ancient family prefixes. The ancient tribe of Waring or Wearing, the Veringi or Veringun (originally from the Veringiford in Norway) formed the celebrated Varangian guard of the Byzantine emperors, which was afterward largely recruited from the North and especially from England.

In England, as of old in Schleswig, the village community formed the unit of English society. Each such township was still bounded by its mark of forest, mere or fen, which divided it from his nearest neighbors and lived a single clan, supposed to of kindred blood and bearing a common name. Many family names are thus perpetuated in England; as the Bassingas at Bassingbourne in Cambridgeshire; at Basingfield in Notts; at Basingthorpe and Basingham in Lincolnshire; and at Basingham in Northumberland. The Billings have left their stamp at Billing in Northampton; Billingford, in Norfolk; Billingham in Durham; Billingley, in Yorkshire; and Billinghamurst, in Sussex, Birmingham, Nottingham, Wellington, Parington, Warrington and Wallingford are well-known names formed on the same analogy. In London alone occur the old Saxon settlements at Kentington, Paddington, Notting-hill, Billingsgate, Islington, Newington, Kennington, Wandsworth, and Bethnal. There are altogether 1,400 names of this type in England.

Totemism consists in the belief that each family is literally descended from a particular animal or plant whose name it bears and members of the family formerly refused to pluck the plant or kill the animal after which they were named. The genealogies of the Anglo-Saxon kings include such names as those of
the horse, the mare, the ash, the whale. In the ancient poem 'Beowulf,' two of the characters bear the names of Wulf and Eoefer (boar); the wolf and the raven were sacred animals. The names on the Christmas boar's head is a survival of the old belief. The oak has left its traces in Oakington, in Cambridge; the birch, at Birchington, in Kent; the boar (eoefer) in Ervingham in Yorkshire; and the horse at Hornington, in Lincolnshire; the raven, at Ravingham, in Norfolk; the sun, at Sunning in Berks; and the serpent (wyrm) at Wormingford, Worminghall and Wormington in Essex, Bucks and Gloucestershire, respectively. Every one of these objects is a common and well-known totem among savage tribes and the inference that at some early period the Anglo-Saxons had been totemists is almost irrefutable.

The suffix *atte*, as implying residence, if not possession, crept in, and thereby arose such names as Atte Bourne, Atte Brigg, Atte Hash, Atte Hay, Atte Kirkstile, Atte Lane, Atte Maydens, Atte Sile, Atte Well; the modern names of Atwood and Atwell occur to us today. The *de* and *atte* were often dropped, hence arose names like Wood, Lane, Briggs. Many names that seem to defy all explanation are disguised beyond recognition; as, who would expect to find Sevenoaks in Snooks; Saint Olave's street in Tooley Street; Saint Etheldreda in Tawdry; Douglas in Diggles; Wilburgham in Wilbraham; Tuberville in Troublemfield; Longueville in Longfellow; Longchamps in Longshanks; Blondewell in Blundell's field; Adburgham in Abraham and Abram; Renshaw in Wrencher and Wrinch; Wymondham in Wyndham. As Mr. Lower truly says: 'Corruptions which many family names have undergone tend to baffle alike the genealogical and etymological inquirer.'

The name of Shakespeare has had at least 27 permutations in old documents; Goodwin, 17; Finnmire or Philimire 59 and 34 of the latter surname.

When the country became settled under Edward the Confessor and the Norseman, Saxon and Welshman lived together under a semblance of law and order, official names arose as Laggman (lawgiver), Fawcett (forseti, judge), Alderman, Shrift, Tabberne, Chamberlain, Chancellor, Chaplain, Clerk, Deacon, Beadle, Latimer (Latinarius, an interpreter), Miles (miles, a soldier), Marshall, Sumner (a summoner, as Chaucer's 'Somnpoure'), Parker (a park-keeper), Franklin (a freeholder), Boiler (butter). Trade names and craft names are of later origin; but it is an open question whether some of the names popularly ascribed to occupations will not bear different interpretation.

Because America is a country made up of all races, it is obvious in the United States a greater variety of names than anywhere else on the globe. Russian, Polish and middle European names seem particularly hard for the American to grasp, and, therefore, immigrants, finding their long names a handicap, are apt to shorten them slightly, reverenced and cons, and Rawitzer is shortened to Rawser. There is also a tendency to translate names. Herr Vogel becomes Mr. Bird, and Mons. Pantofflen is Mr. Slipper. One is amazed at the combinations disclosed in any large directory, as in the firms of Au and Magenheimer, Stretch and Shrink, and the famous Call and Tuttle, Preserved Hookins, Singular Orions Gallyhawk and Esa Hogg must each and all bear grudges against those who infiltrated such names on the commonwealth. But all of these names have appeared in city directories.


**SURPLACE**, a garment of white linen, sometimes adorned with lace, worn over the cassock by priests, choristers and other attendants in the chancel during the service and by ministers in the solemn administration of the sacraments. It is usually a loose, flowing garment, varying in length: in the 12th century it reached to the ankles and this length was prescribed by the Council of Basel (12th century); in the Anglican Church the surplice reaches almost to the feet. In the Roman Catholic Church its length is much less, never extending below the knees, while in the Italian fashion it does not reach nearly so far and is known as the cotta. See Costume, Ecclesiastical.

**SURRA**, a disease of domestic cattle in the Philippines, due to the presence in the system of a protozoan parasite.

**SURRENDER**, in law, the restoring or giving up, as an estate for years, to the reversioner or remainderman, by which act the surrendered estate is merged in the other; also, the written instrument evidencing such surrender. It should be distinguished from a release, which is an alienation of the estate by the reversioner or remainderman to the tenant. It should also be distinguished from a renunciation, which is the refusal to take an estate to which one is entitled by law. A surrender by agreement must be in writing, but it may take place by act of the landlord accepts another person as tenant.

**SURREY**, sur'li, Henry Howard, English poet: b. about 1517; d. 21 Jan. 1547. He was the grandson of the Earl of Surrey who was the victor at Flodden, and who, as a reward for his services, was created Duke of Norfolk. He succeeded to the courtesy title of Earl of Surrey when his father became third Duke of Norfolk of the Howard house in 1524. Surrey became companion to the Duke of Richmond, a natural son of Henry VIII, and in 1533 travelled with him to the French court. He took part in the suppression of the Pilgrimage of Grace in 1536 and in the following year was imprisoned for striking a courtier who had repeated a rumor of his sympathy with the rebels. He served in the army on the Continent and in 1545 was appointed commander of Boulogne, but he was shortly afterward defeated by the French and superseded in his command. Shortly before Henry's death Surrey and his friend Tolins was arrested at the throne and were arrested and lodged in the Tower and Surrey was tried, condemned and executed. In 1538 there was published his translation of the second and fourth books of Virgil's 'Ennius,' the first attempt at blank verse in English. He also wrote many sonnets
after the Italian model. There is an edition of his works in the 'Arber Reprints.' Consult Hales, J. W., 'Folia Literaria' (London 1893).

SURREY, a kind of light carriage having two seats in a box mounted on side bars, four wheels and sometimes a top.

SURROGATES, formerly a deputy, a substitute, a delegate, a person appointed to act for another. In the United States, an officer who presides over the probate of wills and testaments and the settlement of estates. In English law, one appointed by a bishop or his chancellor or by an ecclesiastical judge, to issue licenses for marriages without banns and to deal with probate and kindred matters.

SURROGATES' COURTS. See Court.

SURTEES, ser'tez, Robert, English author: b. Durham, 1 April 1779; d. 11 Feb. 1834. He was graduated from Oxford in 1803 and studied law at the Middle Temple till he inherited his father's fortune. He was elected to the House of Commons for Stockton in 1817, and in 1826 for the Bishopric of Auckland in New Zealand. Henceforth he devoted himself to preparing a 'History and Antiquities of the County Palatine of Durham' (1816-23), to the fourth volume (1840) of which, completed by Raine, a 'History of Surtees Society,' was prefixed. The Surtees Society, founded in 1834 for editing unpublished manuscripts chiefly relating to the northern counties of England, published its 73d volume in 1894. Consult Taylor, G., 'Life of Surtees' (Durham 1852).

SURVEYING, the science of determining accurately the relative locations of points and lines on the earth's surface and of recording the same on maps; it includes also the reverse operation of discovering and locating on the ground points and lines depicted on a surveyor's map.

Two principal kinds of surveying are recognized, plane and geodetic. In plane surveying the area which is the subject of survey is regarded as a plane surface, the curvature of the earth being disregarded. In geodetic surveying, which deals with areas of large extent, the curvature of the earth is considered and given its proper circumstance.

Plane surveying consists essentially of the linear measurement of lines and the special measurement of angles, either vertical or horizontal; together with the subsequent calculation of the content of areas to which such lines and angles appertain. It includes as classes (1) land surveys — the defining of the boundaries of land areas; (2) topographical surveys — the determining of variations in altitude and the denotation of physical characteristics; as, for instance, roads, rivers, forests, swamps, etc.; (3) construction surveys — the staking out of boundaries of railways, etc.

As the earliest records of man refer to skillful measurements and calculations, it is impossible to assign the birth of the science of surveying to any particular year or even century. Foreign states that, according to the Chaldæans, 4,000 camel steps make one mile, 66 2/3 miles one degree, from which the circumference of the earth is 24,000 miles. A papyrus in the British Museum, written 1700 B.C., gives rules for calculating the areas of triangles, trapezoids and circles and the works of Heron of Alexandria (285 B.C.) mention mine surveying and the relatively crude instruments used at that time.

In 1617 Snellius, in Holland, made one of the first attempts to determine accurately the earth's radius. Picard, in 1667, adapted cross-wires to a telescope. In 1735 the French Academy of Sciences sent out two surveying expeditions, one to Peru and one to Lapland. The latter resulted in the first demonstration that the earth is not a sphere but an oblate spheroid. The invention of the vernier by Vennerus in 1631 and of the transit by Roemer in 1672 gave an impetus to the science of surveying, the final results of which are yet to be achieved.

Chain Surveying. — A great variety of work can be done by the use of a chain or tape alone, as, with the measuring of straight lines, the areas of triangles, rectangles and even polygons can be ascertained by dividing the polygon into triangles which are then measured. Angles can be ascertained by laying off equal lengths, b, from the vertex, A, on the two lines, then measuring the third side, a (base of isosceles), and using either of the following formulæ:

\[ \tan \frac{A}{2} = \frac{a}{2b} \quad \text{or} \quad A = \frac{2 \tan^{-1} \frac{a}{2b}}{2b} \]

The angle may then be looked up in a table of sines and tangents. The measurement of inaccessible lines can also be accomplished with the use of only an accurate tape line, as shown in the accompanying Fig. 1. Assume CB to represent the distance to be laid out from C a perpendicular line (CD) to the point D, from which also the point B is visible; and from D lay DC off DC perpendicular to DB, cutting the extension of the line BC at E. There are then the two similar triangles whose corresponding sides are proportional; and we have the proportion—

\[ DC : CB = CE : DC \]

and from which we find

\[ CE = \frac{DC^2}{DC + CB} \]

It remains only to measure DC and CE with the closest accuracy possible and to substitute their values in the proportion. The laying off of the perpendicular to the point B is made by the use of the pons asinorum of the geometry — the square of the hypotenuse of a right-angled triangle is equal to the sum of the squares on the other two sides. In surveying practice this becomes the striking off of two conical points X and Y respectively, these two points being eight feet apart. The radius of the curve from X is to be six feet, and that from Y 10 feet. The point Z where these curves intersect will be in a perpendicular to XY from the point X, the angle XYZ being a right angle. But such measurements are not comparable with work done with the aid of the transit.

Compass Surveying. — The use of the azimuth compass is considerably restricted for several reasons, namely: The magnetic needle points north at but few places on the earth, the disagreement varying from 1° to 30° from true north. This disagreement, or the angle between true north and the magnetic needle, is called the declination of the needle. The declination does not remain constant, however, there being diurnal, annual and local variations from the normal declination which introduce unknown errors in the compass survey. The diurnal variation is usually not more than 6 minutes but may reach 20 minutes. It is usually zero at 11 o'clock A.M.; the annual,
1 to 2 minutes, and the local variation amounts to as much as several degrees in some localities, owing to deposits of iron ore near the surface. Errors from this source may be avoided by back sights at each station. There are also secular variations in the declination, so that when retracing the lines of a compass survey made several years previously, the surveyor must use the same declination used in the original survey. In making a compass survey it is necessary to determine the declination of the needle by an observation on a polar star, or on the sun with the aid of a solar attachment (see below). The stellar observation is usually made on Polaris which, however, is not precisely at the north pole. It is necessary, therefore, to make the observation exactly at the time of upper or lower culmination, or at eastern or western elongation; a correction being required in the later case. Tables have been published, however, by the United States Land Office for taking the observations on Polaris at any convenient time.

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<td>298.58</td>
<td></td>
<td></td>
<td>45.10</td>
<td>400.68</td>
<td>200.58</td>
<td>45.10</td>
<td>200.58</td>
</tr>
<tr>
<td>2-3</td>
<td>5°50' 42&quot; W</td>
<td>150.00</td>
<td>128.98</td>
<td>30.38</td>
<td>48.07</td>
<td>202.30</td>
<td>375.16</td>
<td>702.35</td>
<td>673.74</td>
<td>202.30</td>
<td>375.16</td>
</tr>
<tr>
<td>3-4</td>
<td>6°20' 5' W</td>
<td>140.00</td>
<td>131.49</td>
<td>30.38</td>
<td>48.07</td>
<td>202.30</td>
<td>375.16</td>
<td>702.35</td>
<td>673.74</td>
<td>202.30</td>
<td>375.16</td>
</tr>
<tr>
<td>4-5</td>
<td>6°12' 35&quot; W</td>
<td>75.00</td>
<td>32.07</td>
<td>48.74</td>
<td>209.00</td>
<td>48.74</td>
<td>398.71</td>
<td>501.53</td>
<td>146197</td>
<td>48.74</td>
<td>398.71</td>
</tr>
<tr>
<td>5-6</td>
<td>6°50' 39&quot; W</td>
<td>300.00</td>
<td>63.10</td>
<td>102.76</td>
<td>000.00</td>
<td>102.76</td>
<td>6689.68</td>
<td>6689.68</td>
<td>6689.68</td>
<td>6689.68</td>
<td></td>
</tr>
<tr>
<td>6-1</td>
<td>6°57' 39&quot; W</td>
<td>121.66</td>
<td>63.10</td>
<td>102.76</td>
<td>000.00</td>
<td>102.76</td>
<td>6689.68</td>
<td>6689.68</td>
<td>6689.68</td>
<td>6689.68</td>
<td></td>
</tr>
</tbody>
</table>

Government Land Surveying.—The first public surveys in the United States were made in the State of Ohio under an ordinance of the Continental Congress passed 20 May 1785. This ordinance was slightly modified by an act of Congress, passed 18 May 1796. This act, which is still in force, provided that all public land, except certain private land grants, shall be divided into townships six miles square, and that sections shall be subdivided into one-fourth sections one-half mile square. The act further provides that all lines of public land surveys shall be run on either true meridians or true parallels of latitude. The method of surveying townships and sections is as follows: First — In each State, or convenient group of States, there is established a principle (true) meridian, and, at right angles thereto, a base line conforming to a true parallel of latitude. Second — Standard parallels or correction lines, also conforming to parallels of latitude, are established at intervals of 24 miles north and south of the base line. Third — Guide meridians conforming to true meridians are initiated at intervals of 24 miles along all standard parallels, and run due north to the intersection of the next standard parallel. Fourth — The rectangles thus formed by the guide meridians and standard parallels are subdivided into 16 townships. As meridians converge toward the north pole the north boundary lines of townships are less than six miles long and offsets required at any latitude in the United States.

Traversing.—This is a method of surveying a polygon by surveying its perimeter only, as distinguished from the method of cutting the polygon up into triangles (Fig. 5). In a traverse survey the transit is usually oriented at each station, thus referring all bearings to a magnetic meridian. In mapping such surveys the "north point" shows the magnetic north at the date of the survey and a skeleton arrow is drawn through it showing the needle's declination at that time and place from true north. It
is not necessary to take convergence of the meridians into account except in geodetic work. The method of procedure is as follows: The transit is set up at station No. 1 and the bearing and distance of the first course determined. The transit is then removed to station No. 2. With vernier 
\( \Delta /x \) still at the previous reading, the lower spindle is unclamped and a plumbed rod bisected at station No. 1, with the telescope inverted. The telescope is then revolved to its normal position, unclamped, and the bearing and distance to station No. 3 ascertained. The transit is then removed to station No. 3 and the operations repeated. To illustrate this important branch of surveying the tabling of a traverse and the rules governing the same are given in the table on the preceding page.

In the foregoing "tabling" the latitude and departure of each course is found by multiplying the distance by the cosine and sine of the angle expressed by the bearing. The latitude and departure ordinates are self-explanatory.

The single meridian distances are the departures of the respective stations from the most westerly station. The double meridian distances of the respective courses are equal to the sum of the single meridian distances of the stations at each end of the respective courses. Each North and South area is equal to the product of the latitude of a course into its corresponding double meridian distance. The area of any polygon is equal to one-half the difference between the sum of the North and South areas. When the course and distance of any side of any polygon is lacking it is found as follows: Ascertain the difference between the north and south latitudes and the difference between the east and west departures. Divide the difference in departures by the difference in latitudes for the tangent of the bearing. Divide the difference in departures by the sine of the bearing found, for the distance.

Topographical Surveying.—In order to facilitate the selection of a route for a railroad, to properly locate an irrigation reservoir or dam for power purposes, or to correctly make a geological survey of a large area it is generally necessary to make a topographical survey of the area under consideration. From the field notes of the survey a map is made showing the surface elevations with considerable particularity by a system of contour lines at stated differences in level, and also showing all important objects, such as buildings, roads, canals, fences, streams, etc. There are several methods of making a topographical survey. First, by the use of a tape, level and transit. Second, by the use of the plane-table. Third, by the use of a transit and stadia rod. The last-named method alone will be discussed here, it being the method usually adopted, on account of its celerity and low cost. Stadia wires are two horizontal wires placed in an adjustable ring so that they appear at equal distances above and below the horizontal cross-wire when looking through the telescope.

The theory of stadia measurements is based on the two following equations:

\[
\begin{align*}
1. & \quad \frac{1 + \frac{1}{f_1}}{f_1} + \frac{1}{f_2} = \frac{1}{f} \\
2. & \quad \frac{1}{f_1} - \frac{1}{f_2} = \frac{1}{f} 
\end{align*}
\]

in which \( f_1 \) is the height of image or distance between the stadia wires, \( c \) the height of object or the stadia reading on the rod, \( f_2 \) the

![Diagram](image-url)

**FIG. 4.—Land Surveying Secant Method.**

...
In topographical field work where the area to be surveyed is considerable it is usual to first lay out a triangulation net work, all measurements being made with a tape or by triangulation from an accurately measured base line and the stadia measurements taken from the triangulation stations. In work of less magnitude it is not necessary to lay out a system of triangles, but all measurements from station to station are carefully made and checked by cross-readings. The location of objects is quickly and accurately accomplished by sights from two different points of the measured line. In making a map of a topographical survey there are several methods employed. One requires the use of a T-square and brass protractor, another and a better method is by the use of a protractor sheet larger than the sheet upon which the drawing is to be made. After all distances are laid off and the heights indicated at the various points, contour lines are drawn in by proportioning the distances and heights; or reference to heights. Sometimes the contour lines are drawn in pencil to be afterward erased and the hatchure method of representing topography employed.

Mine Surveying.—The chief purposes of an underground survey are to ascertain the amount of ore in sight, to find the pitch and position of the "pay chute" with respect to the shaft and levels, to find the "dip" of the vein and also to ascertain and lay out the direction of connections commonly called "hollings." Moreover the laws of some States and countries require plans of the underground workings to be kept on file. Ventilation being one of the serious problems in mining—especially coal mining—it is generally necessary to make passageways or "hollings" connecting the various drifts and levels in such a way as to facilitate the circulation of fresh air throughout the mine. In order to make these connections a careful transit survey is necessary, the compass needle being unreliable in the presence of pipes, rails, ore cars, etc. While mine surveying does not call for the precision of a geodetic survey, cases arise requiring great skill and ingenuity. One of the chief difficulties is to transfer the bearings and azimuths to mine line to work later. This is especially difficult if the survey has to be carried down a deep vertical or inclined shaft. In vertical shafts heavy plumb-obs suspended in pails of water or molasses at the bottom of the shaft by means of wires reaching to the surface have been successfully used. A transit with a secondary telescope, so attached to the extended axis of the primary telescope that it may be sighted vertically downward, is also used for this purpose. In underground work it is necessary to mark points out and internal to the mine to make tape measurements on the slope or level as the circumstances may permit. Illuminated plumb-lines are used for fore and back sights and it is also necessary to hold a candle so as to illuminate the telescope cross-wires. Permanent pegs for future use are usually placed in the roof instead of in the floor of a drift and even then their position must be often checked for ground moves considerably in some mines.

Geodesy.—This branch of surveying has for its object the exact location of points and lines with reference to the true form of the earth. In most geodetic work the earth is assumed to be an oblate spheroid, all measured angles and distances being reduced to spheroidal angles and distances. The United States Coast and Geodetic Survey has adopted the Clarke's spheroid of 1866. The foundation of a geodetic survey is a base line. This is most carefully measured with specially constructed bars of invar steel (q.v) encased in wood, called a "Base line apparatus." Base lines can be measured with steel tapes with an accuracy of one in 1,000,000 under favorable circumstances. These tapes have a screw adjustment for temperature as shown by a thermometer in the handle and there is also a helical spring attachment for regulating exactly the pull used in stretching the tape. Two tapes are used in each measurement and, in case of disagreement, are compared with a third and fourth tape. An accuracy of one in 300,000 is generally accepted as satisfactory. With a base line as a nucleus, a system of triangulation is put over the surrounding country, additional base lines being measured from time to time to serve as a check upon the work. In a primary triangulation the sides of the triangles are very long—20 to 100 miles. The first series of triangles laid from the base line are as nearly equilateral as can be made. This conduces to accuracy in the larger triangles. Within the primary triangles secondary and tertiary triangles are laid out, the lines of which are from 1 to 20 miles in length. Angles are measured with specially constructed transits, average results of several readings by the "continuous reading" method being necessary. The unknown sides and angles of the spheroidal triangles are calculated and, when possible, the angles are checked by actual observation. Vertical angles are also read at each station and corrected for refraction and curvature of the earth. The permissible error in a primary triangulation by the United States Coast and Geodetic Survey is one-fourth inch per mile or one in about 250,000; the permissible error in the measurement of an angle is three-tenths of a second and the closing error must not exceed five seconds, or one in about 250,000. As it is impossible to attain such accuracy it is necessary to adjust the angular measurements by a system of averaging errors. In determining the azimuth of any geodetic line the convergence of the meridians has also to be taken into account.

Hydrographic Surveying.—This includes surveys for determining the depths of water in rivers, bays and harbors for purposes of navigation; the determination of velocity and direction of currents; the location of hidden rocks or shoals and buoys, lights, etc.; and the determination and measurement of all soundings carried by streams and deposited in bays. Permanent bench-marks and stations are generally made on shore, and the points at which soundings are taken located by triangulation. There are several methods of locating sounding points. First, an observer is stationed at each end of a base line. At the instant the man on the water makes a sounding he signals the two transmitters to take their observations for azimuth. Second, by the "three point problem." That is, by reading from the
SURVEYING

boat two angles to three points on shore whose relative distances are known. Of course, sextants only can be used for measuring angles from the boat.

Soundings are taken in feet or fathoms, the mean water level being taken as the datum plane. For tide waters the average sea-level is also taken as the reference. In some cases automatic tide-gauges are kept in operation for one or more years to determine an average sea-level.

The velocity of water currents in large streams is ascertained by means of a current metre, several styles being in use. The flow of the water in small streams is best determined by means of a weir.

Photographic Surveying.—The use of the camera in surveying is comparatively recent and, though its use is restricted in many ways, it has come into quite general use. It may be called a successful rival to the plane-table. Photo-surveying has been used with success in Italy, India, France, United States and Canada. In this latter country it has supplanted the plane-table almost entirely.

The advantages of a photo-transit are that with it more rapid and cheaper work can be done than by any other means. The results, however, are not as satisfactory as with the plane-table. The photo-topographer must have a thorough knowledge of perspective drawing, descriptive geometry and photography. The instrument used consists of a compass or a horizontal, graduated plate with a vernier, to which is attached a camera having a sensitive level and a means of very accurately measuring the focal length at the time each view is taken. If a box camera having a universal lens is used this latter requirement is not necessary. There is also attached to the top or side of the camera a telescope having stadia wires and a vertical circle. Some styles have a scale so placed in the box that it is photographed on the plate when the view is taken. In any case four projecting needles or two cross-wires are so placed in the box that they will make the horizon line and line of sight in the developed negative. The stadia rod is also photographed as a part of the record. The topographical map is drawn in accordance with the principles of perspective drawing and descriptive geometry, from measurements taken from the photograph, the compass bearing and stadia measurements being taken into account.

Plane-table Surveying.—A plane-table consists essentially of a drawing board mounted upon a tripod together with an alidade, an alidade being a graduated ruler carrying a telescope. (Fig. 3). A graduated vertical circle for measuring vertical angles is attached to the telescope, and stadia wires for measuring distances are often inserted in it. In operation the drawing board is covered with a sheet of drawing paper and the alidade telescope sighted consecutively to the various objects which are to be represented in the drawing. Pencil lines are drawn on the paper along the edge of the ruler at each sighting. The plane-table is then set up over another station whose relative position has been fixed by survey with respect to the first station, and sights taken to all the points sighted from the first station. The pencil lines will intersect at the points which represent the respective objects. Stadia readings are often taken with the alidade telescope, the true elevation and horizontal distances being taken from a slide rule constructed for that purpose. The plane-table is much used by the United States Coast Survey and the United States Geological Survey, as more topographical work can be done in less time by its use than by any other means except photo-topography. Errors in azimuth are impossible and more complete work can be done by making the drawing in the field than by plotting from field notes in the office.

Railroad Surveying.—Railroad surveys are either preliminary, for the study of the terrain, or for the purpose of actual location. A preliminary survey is often nothing more than a topographical survey of a comparatively wide strip of country through which it is expected to run the line, a paper location being made in the office and the location survey of the paper location afterward made upon the ground. While a topographical survey gives little or no information regarding cuts and fills it is of great value in deciding upon the most advantageous location.

Briefly stated a railroad location survey consists of a survey of curves, the tangents joining them and the grades. Tangents and curves are laid out with a transit, the grades and cross-sections being worked out with a level. From the cross-section field notes the cubic yards of earth or rock in the cuts and the volume of the fills is computed in the office. The grade line is so located that the material taken from the cuts will furnish enough material to make the fills. All straight portions of a railroad are called tangent, and the curves are surveyed as the sides of an inscribed polygon of equal sides, each side being 100 feet. (Fig. 6). The degree of curve is the angle at the centre (of the circumscribed circle) subtended by a chord of 100 feet. The length of curve, ℓ, is the sum of the sides of the inscribed polygon. The central angle, θ, is the angle at the centre included between the radii which pass through the tangent points. It is equal to the external angle of the polygon, that is, the deflection angle of the tangents. The tangent distance, T, is the distance from the vertex to
either tangent point. The conditions are such that in any railroad curve:

\[
\begin{align*}
1. \sin \frac{1}{2}D &= \frac{C}{R} & 4. \sin \frac{1}{4}d &= \frac{\sin \frac{1}{2}D}{100} \\
2. T &= R \tan \frac{1}{2} \Delta & 5. R &= T \cot \frac{1}{2} \Delta \\
3. L &= 100 - \frac{\Delta}{D}
\end{align*}
\]

By means of the above and other formulas all the elements of a railroad curve can be computed. Where tracks are to be laid especially for trains of certain speed it is the practice to lay out compound curves approaching closely the parabola, in order to make a more gradual transition from tangent to curve. When passenger and freight trains run upon separate parallel lines the outer rail of the passenger line is made higher than the outer rail of the freight line, to better counter the higher centrifugal force at the greater rate of speed. There are several methods of surveying a railroad curve: by tangent offsets, by ordinates from a long chord, by middle ordinates, by offsets from chords produced and by deflection angles. Circumstances determine the method to be used. Tables are published giving the formulas and other information needed by the railroad surveyor.

**Leveling.** Ordinary leveling is usually done with either a "Dumpy" or a "E" level, the latter being favored by American engineers. The accuracy of the "E" level is due to its construction, which permits the telescope to be reversed in the Y's. Some levels have stadia wires inserted for reading distances in some cases these are so placed that they can be blown out of focus by revolving the eye piece, thus making it impossible to make an error by reading a stadia wire instead of the central cross-wire. In order to increase the clearness and sharpness of vision, levels are often rendered "inverting" by omitting one lens. Ordinary leveling rods are made to telescope that is, lengthen or shorten — and are usually graduated into feet, tenths and hundredths of feet, but they can be read to thousandths of a foot by the aid of a vernier attached to the target. In precise leveling three methods are practised by the United States government, depending upon the instruments used. The United States engineers employ the "Kern" level and a "speaking" rod, the United States Coast and Geodetic Survey a peculiar instrument called a Geodetic level, which requires lengthy and expensive computations. The United States Geological Survey employs a modification of the ordinary Y level and either "speaking" or target rods. In precise leveling the fore and back sights must be taken at the same distance, otherwise a correction for curvature of the earth must be applied. One method of checking a line of levels is to level back over the same line of pegs. Another and a better check method is to employ two rods and make a check in a nest. In one levelman, two independent lines of turning points being run. Precise level rods are usually non-telescopic; that is, made in one piece, and the wood is heated and then paraffined. Graduals are sometimes on strips of metal countersunk into the wood. The limit of permissible error United States Coast and Geodetic Survey is 0.02 × √distance in miles, the product exceeding in feet.

**Solar Attachment.** This is an instrument which may be attached to a compass or to an instrument in determining the meridian, and time by observations made on it. There are various forms of manufacture by various firms and the Smith being those most widely used. The solar is usually seen on the transit telescope and it is used at time of day, the early morning, late evening and noon hours being avoided for reasons of lengthly to be explained here.

In order to determine the true meridian declination of the sun at the time of observation. A solar ephemeris or nautical almanac will give the sun's declination at Greenwich, England, for each day of the year. The surveyor must correct this declination for longitude (q.v.), hours from noon, a fraction of a degree, the observation refraction correction varies with the latitude (q.v.), hours from noon and declination of the sun. Having found the declination needle, the compass box is moved so that the needle at N. and S. in which will indicate true bearings.


**O. H. P.**

Mining Engineer, San Francisco

Revised by Richard P.

S. SURVEYING, Marine. See Surveying.

S. SURVEYING INSTRUMENTS. Instruments used in the business of surveying fall into two general classes: those used in field work and those used in recording the work on maps. In both classes there are objects to be attained, and suitable instruments are provided for each—the marking of the measurement of lines and the measurement of angles.

In field work the "pin" is the instrument used for the temporary location of a point. It is made of stout iron wire, or a steel wire, about eight inches long, with a ring turned at the top. To go around it goes one levelman, two independent lines of turning points being run. Precise level rods are usually non-telescopic; that is, made in one piece, and the wood is heated and then paraffined. Graduals are sometimes on strips of metal countersunk into the wood. The limit of permissible error United States Coast and Geodetic Survey is 0.02 × √distance in miles, the product exceeding in feet.
1 Transit, with Segmuller Solar attachment
2 Y-Level
3 Plane Table
monument marked with a simple cross

the stone, or a bronze bolt may be set

hole drilled in the top of the monument.

making linear measurements a long-rec

standard had been the surveyor's or s

chain. It is 66 feet in length, made up

links of stiff iron wire or steel, with a

aped loop at each end, the adjacent links

connected by two rings. Each measured

7/1000 of a foot, or a hundredth of a foot.

portion of the rod was raised upward until

the target could be seen in the line.

The reading now is taken on the

side of the rod, which is also graduated, so

that distances up to 12 feet may be measured

to the thousandth of a foot. To ensure the verticality

of the rod in the hands of the

small blocks of brass soldered upon it,

the exact points being indicated by

filed in the brass. These ribs are

ly provided with a compensating handle

forward end of the chain. This han

section of two sections of brass tubing, one of

contains a thermometer and an adjust

so that the length of the chain may

longer or shorter according to the

of the thermometer — the chain hav

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The other section of the handle contains

level, to ensure that the measurement is

horizontal; and a stout helical spring

must be drawn out to an index mark, and

sures that in every measurement the same

tension is exerted upon the chain.

ape of chain cannot be bundled up as

e link type, and a folding reel is provided

which it is safely carried about. For

measuring, the lines marking the tent

employed. This is a ribon of steel

half an inch in width and one-eighth

dhundredth of an inch in thickness. It is

ed in feet, tenths and hundredths of a

etched upon the steel that the divisions in

relief. This type of tape line rolls

means of a cranked handle into a leather

Linen tapes and combination tapes of

nd brass wire are useful in some in

, but cannot be depended upon where ac

important. Tapes and ribbon "chains" are

authoritatively tested if sent to the Su

ondent of the United States Coast Survey

hington. Measurements of extreme

, as in the establishment of a base line

igation, are made with "base bars" or

station bars" so constructed of iron and

at they remain the same length regard

changes in temperature. These bars are

about in cases of wood, and are used in

six, being each supported on two stout

notches are made on each bar, and

rough in which is kept continually while

a mixture of ice-water and ice — thus a

constant temperature of 32°, to which

are standardized. The steel alloy as

"invar" (q.v.) is also used with entire

satisfaction within a certain range of tempera

atures, in which the metal does not expand in

length. For measuring small vertical distances, as

in leveling, a telescoping rod is used. The type

most in use is the New York Leveling Rod. This rod

is of maple, about two inches square and nearly

seven feet in length, and has a brass shoe and a brass cap. The face of

the rod is graduated into feet, tenths and

hundredths of a foot, and is sighted by means of a num

The reading is taken when the

measuring target of oval outline has its centre cut

away so that the graduations of the rod are

visible. On one of the inner edges of the tar

get a vernier is provided so that thousandths

of a foot may be read. The rod is made in

two longitudinal sections dovetailed together,

the back section sliding upon the front. When

a vertical distance of more than 6.50 feet is

to be measured, the target is clamped at that

figure, a lower clamp loosened and the back part

of the rod raised upward until the target comes

into line. The reading now is taken on the

side of the rod, which also is graduated, so that

distances up to 12 feet may be measured to the

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stadia wires is often added to the cross-hairs of the telescope, so that the distance of the leveling rod may be computed by taking a second reading above or below the level line at the time when the level is fixed. An ingenious device renders the stadia wires invisible when the cross-hairs are being used, and vice-versa. A small pocket level known as the "Locke Level," is of great usefulness in reconnaissance work. In this instrument the bubble tube is attached to the top of the tiny telescope, the upper part of which is cut away, and a semi-circular mirror at 45 degrees placed beneath it in the telescope. The image of the bubble in the mirror decides when the instrument is held in a true level position, and at the same moment the point at which the level line strikes the leveling rod is in plain view.

For the measurement of angles in the field the commoner instruments are the magnetic compass and the transit. The former depends upon a continual reference of the direction of a line to the magnetic north-and-south line indicated by a magnetic needle swinging in a compass box, the rim of which is graduated to 15 minutes of arc, from which the angle can be very closely estimated to five minutes. By an attachment to the compass it may be made a solar compass, a necessity where the principal lines of the survey are referred to the true meridian, as in government surveys of the public lands. The compass may be still further improved by the addition of a telescope, which may be clamped to the rear sight, and this telescope may have a large bubble tube, making it available for running levels, and it may also carry a vertical circle for measuring vertical angles.

The transit is the engineer's instrument of precision for angular measurements. Its essential factor is the plate, from five to seven inches in diameter, bearing graduations of exquisite accuracy, to 30 minutes of arc in the smaller instruments and 20 minutes in the larger ones. Verniers are affixed at opposite sides of the plate by which the angular measurement may be made to 30 seconds in the one case or to 20 seconds in the other. The telescope which carries the line of sight with the intersection of cross-hairs is often fitted with stadia wires also, so that the tangents of the distances may be measured upon a leveling rod. A long bubble tube enables the engineer to use the transit for all ordinary leveling work. It is not uncommon to have a four-inch vertical circle attached, carried on four arms, and reading to single minutes. A solar attachment, consisting of three arcs of circles, on which the altitude of the place, the declination of the sun and the hour of the day may be set off, converts the instrument into a solar transit. Where a vertical circle is a part of the instrument, this serves for the latitude arc. The transit shown in the illustration is equipped with the popular Saegmüller solar attachment mounted above the primary telescope. A special form of the transit for mining engineers has the axis of the telescope extended beyond the standard at one side, and a second telescope mounted upon it so that a sight may be made directly downward. For very accurate and extended work, as in geodetical work, the telescope of the transit is sometimes 36 inches in length, the horizontal graduated circle 36 inches in diameter and the vertical circle 24 inches in diameter.

The plane table is practically a drawing board, usually 24 by 36 inches. In its simplest form the ruler or "sampling" carries sights at the ends by which the direction is obtained, the line of this direction being then drawn along the ruler upon a sheet of paper attached to the board. In the better class of instrument the sights are replaced by a telescope, which sometimes carries stadia wires for measuring distances, a compass box for orientation and short vertical arcs for measuring tangents which cannot be covered by the stadia wires. The plane table is of use chiefly for surveying topographical details upon the map by ordinary surveying methods. The plane table shown in the accompanying illustration is equipped with reds for carrying a continuous roll of drawing paper. See Surveying.


SURVEYS, United States Governmental. From an early period in its history the government has made provision for exploring expeditions of various kinds, mainly in the vast region west of the Mississippi which for many years was a but little known wilderness. Some of these explorations were for military routes to the west and later came surveys of public lands. The first official surveys were made by a geographer attached to the Continental army in the Revolution and in 1781 Thomas Hutchins (q.v.) was attached to Greene's division (Southern) as geographer. After the Revolution he was retained to supervise surveys of the Western lands and continued in office until his death in 1789.

The earliest governmental explorations, the West could hardly be regarded as surveys, although many of them prepared maps which added greatly to knowledge of a little-known region. Positions were determined astrue.
ically, and route maps were the principal products. The first of these was the Lewis and Clarke expedition sent out by President Jefferson in 1803. One of its products was a map of the country between Lake Superior and the Pacific Ocean between the 39th and 49th parallels. Major Z. M. Pike's expeditions in 1805-06 and 1807-08 explored Mississippi and the Arkansas and Red rivers were fruitful of geographic results. Major S. H. Long's expedition from Pittsburgh to the Rocky Mountains in 1819 and 1820 was under order of the Secretary of War. In 1836, a party under the command of Lt. C. Brown made another journey to the Great Lakes and the source of Saint Peter's River. Sextant and pocket chronometer were used, distances were estimated and courses were taken by compasses. The most elaborate early survey was that of J. C. Brown of a road from Osage to Topeka in 1825-27. Chain compass and a good sextant were used and a large scale map prepared. Similar to it are the surveys by R. Richardson of a road from Little Rock to Fort Gibson in 1826, and a survey by Major J. W. Albert of a military road from Fort Smith to Fort Leavenworth. In 1832 Lieutenant Allen on the Schoolcraft expedition made an excellent map on a scale of 5.75 miles to an inch, of the head of the Mississippi Valley but all the distances were estimated. He was the discoverer of the source of the great river.

The Bonneville expedition in 1832-36 was not under governmental authority although Bonneville was an army officer. The Wilkes expedition in 1840 surveyed part of Columbia River. The first of the early expeditions which could be regarded as a geological survey was made by Featherstonhaugh in 1834 to the Ozark region. The following year his observations were extended along the Couteau des Prairies between the Missouri and Minnesota rivers. In 1838 Nicollet was sent by Colonel Abert of the United States Army Engineers to make a map of the hydrographic basin of the Mississippi River. In 1839 and 1848 D. D. Owen made surveys of mineral lands of the Northwest extending to Lake Superior and covering an area of 57,000 square miles. These surveys were made for the United States Land Office. In 1847-48 C. T. Jackson and J. D. Foster and J. W. Whits and others, operating under orders of the Secretary of the Treasury extended this work in the copper district of the Lake Superior region.

Corps of Engineers, United States Army.

—A large amount of surveying was done by the topographical engineers of the United States army. The first notable expedition under that bureau was N. Nicollet's explorations of the basin of the upper Mississippi River in 1836-40 which resulted in a map which is regarded as a most important contribution of American geography. His surveys were largely instrumental and he used a barometer for ascertaining elevations. The Fremont expedition in 1842 resulted in a valuable map on the millionth scale, of the country from the forks of Platte River to South Pass between the 43rd and 45th parallels. Expeditions by Fremont in following years 1843-46 extended his observations westward to the Pacific Ocean and the surveys made were the basis for important new maps.

The following is a list of some of the more notable army expeditions and surveys from 1836 to 1879 (excepting the surveys for Pacific railroads which are noted on following page):

**LIST OF PRINCIPAL SURVEYS UNDER THE BUREAU OF TOPOGRAPHICAL CORPS OF ENGINEERS, UNITED STATES ARMY.**

1836-40. I. N. Nicollet...
1843-44. Capt. J. C. Fremont...
1844. Capt. G. W. Hughes...
1845. Lieut. W. Albert...
1846-47. Maj. Wm. H. Emory...
1847. Lieut. G. B. Robinson...
1847. Lieut. J. D. Webster...
1849. Lieut. J. H. Simpson...
1849. Lieut. J. H. Simpson...
1849. Capt. E. Stanbury...
1849. Capt. John Pupe...
1850. Capt. H. Kern...
1850-51. Capt. Sitgreaves and Lieut. Woodruff...
1851. Lieut. Derby...
1851. Capt. R. B. Marcy...
1853. Capt. J. H. Remo...
1854. Lieut. G. H. Derby...
1855. Lieut. G. H. Hendry...
1855. Lieut. G. K. Warren...
1856. Lieut. G. K. Warren...
1857. Lieut. J. C. Ives...
1858. Lieut. N. Macomb...
1859. Capt. J. H. Simpson...
1859-60. Capt. W. P. Reynolds...
1860. Capt. Chaas. W. Raymond...
1860. Lieut. Geo. M. Wheeler...
1860. Capt. D. P. Heap...
1861. Capt. J. B. Proctor and I. D. P. Heap...
1861. Capt. A. Jones...
1863. Capt. Wm. Ludlow...
1864. Lieut. E. B. Logan...
1865. Capt. W. A. Jones...
1865. Lieut. E. B. Logan...
1865. Capt. Wm. Ludlow...
1871. Capt. W. S. Stanton...
1885-79. Capt. G. M. Wheeler...

Upper Mississippi Basin.
Missouri River to Rocky Mountains.
Rocky Mts. and to Oregon and northern California.
San Antonio to Saltillo, Mexico.
Between Platte River and 38th Parallel to Rocky Mts.
Fort Leavenworth, Mo., to San Diego, Cal.
Part of Sacramento Valley.
Rio Grande from north of Matamoras.
Road from Fort Smith to Santa Fé.
Navajo County.
Valley of Great Salt Lake.
Red River of the North.
Rio Pecos.
Survey of Creek Boundary.
Down Zuni and Colorado rivers.
Colorado River Mouth to Fort Yuma.
To sources of Red River.
Big Sioux to Mendota.
Oregon and Washington Territories.
Snake River.
Dakota and Sioux County.
Missouri and Yellowstone rivers.
Territory of Nebraska and Black Hills.
Colorado River from Fort Yuma to Grand Canyon.
Santa Fé to junction of Green and Grand rivers.
Great Salt Lake Valley.
Headwaters of Yellowstone and Missouri rivers.
Route from Fort Dallas, Ore., to Great Salt Lake Valley.
Yukon River Basin.
Southern and southwestern Nevada.
Northern Montana and Dakota.
Upper Yellowstone County.
Uinta Mountains.
Yellowstone River.
Ut. County.
Northwestern Wyoming and Yellowstone Park.
Port Garland, Colo., to Fort Wingate, N. Mex.
Black Hills.
Carroll, Mont., to Yellowstone Park.
Big horn and Yellowstone Valley.
Routes in Wyoming.
Geographical Surveys west of 100th Meridian.
There were also many reconnaissance trips and explorations for roads which could hardly be called surveys. Some of the maps were not published but remain on file in the War Department.

Hills Survey.—In 1874 Capt. W. Ludlow made expeditions through the Black Hills of South Dakota with N. H. Winchell as geologist. The results were given in a quarto volume issued in 1875. Later the Indian Bureau took an expedition under W. F. Jenney and H. E. Newcomer to investigate reports of gold in these hills and a quarto report with folio of maps was published by the Survey of the Rocky Mountain region.

Pacific Railroads.—In 1853 the War Department began a series of explorations for routes for railroads across the Far West. The expeditions were conducted by army officers but had topographic and geologic assistants, who made surveys of various kinds. Among these geologists were Jules Marcou, Thomas Antisell, J. S. Newberry, W. P. Blake and James Schiel. The routes surveyed were not far from the several transcontinental railroad lines of to-day. The results were published in 13 topographic memoirs, not all of which had geographic results of the surveys but a large amount of information on natural history, resources, etc.

International Boundaries.—The boundaries of the various States have been surveyed by various organizations. In 1818 surveys were begun on the northern boundaries of New York, New Hampshire and Maine by United States army engineers. In 1822 (?) the Northwest Boundary Commission, appointed under the Treaty of Ghent, made a survey of the boundary in the region about the outlet of Lake Superior, and in 1857-61 the United States Commission working under direction of the State Department surveyed the boundary west from longitude 110°. In 1872-75 the United States Boundary Commission under the State Department surveyed the Canadian boundary along the 49th parallel and a narrow strip of contiguous country from Lake of the Woods to the Rocky Mountains, crossing the border with the survey from the west. The Louisiana-Texas line survey in 1840 was made jointly by engineers of the United States army and surveyors appointed by Texas. The results are in Senate Ex. Doc. 190, 27th Congress, 2d Session. Considerable boundary surveying has been done by the Coast and Geodetic Survey. The Mexican Boundary Survey was made by Maj. W. H. Emory in 1853-56 and its results were published in two quarto volumes which included geological observations by Parry and Schott. Detailed remapping of this boundary in 1889 was done by a joint International Boundary Commission consisting of three Mexican members, two army engineers and a member of the United States Coast Survey. The result was a folio of maps showing topography and profiles from El Paso to the Pacific. The southern boundary of Kansas was surveyed by Lieut.-Col. J. E. Nicollet in 1833 and the Texas boundary in 1858-59 by a commission organized by the Interior Department.

Lake Survey.—A survey of the Great Lakes was made by the War Department (corp. of engineers) in 1841 to 1861. Very detailed charts (170,000 square miles) and a chart of the Great Lakes were published by the Survey of the Rocky Mountain region.

Hayden Survey.—The survey under F. V. Hayden began in 1867 for the General Land Office and its work was in Nebraska Territory, but it was not until 1871 that it began much surveying. In 1873 it became the United States Geological and Geographical Survey of the Territories and in the next five years covered 170,000 square miles of survey and topographic and geologic mapping, mostly in Colorado, Wyoming, Idaho and Montana. James T. Gardner was chief geographer and A. D. Wilson and Henry Gannett were in charge of parts of the work. The principal geologists were A. C. Peale, W. H. Holmes, A. R. Marvine, F. H. Endlich and F. V. Hayden. Twelve annual reports and a series of quarto memoirs were published.


Fortieth Parallel Survey.—This survey was organized and conducted by Clarence King under direction of the chief of engineers, United States army, operated from 1867 to 1872. It prepared topographic (contour) maps and geological map of a wide strip of country contiguous to the 40th parallel west of the 106th meridian. The geological work was by Clarence King, S. F. Emmons, Arnold Hague and James D. Hague. John D. Gardner was in charge of topographic work. The results were published in seven quarto volumes and a map of the Wheather Survey. From 1869-79 extensive explorations were made in the West under direction of Capt. G. M. Wheeler of the United States army engineers. The title of the organization was United States Geographical Surveys west of the 100th meridian. Many hachured topographic maps were prepared of parts of Arizona, Utah, New Mexico and Colorado and the geology of various regions was mapped by G. K. Gilbert, A. R. Marvine, E. E. Howell, J. J. Stevenson, I. C. Russell and others. The principal results were published in three quarto volumes issued in 1873, 1881 and 1889.

United States Geological Survey.—In 1876 there were four geological surveys in progress, the Hayden, King, Wheeler and Powell with some duplication of work, a condition which aroused so much criticism that Congress referred the consideration of the continuation of the work to the National Academy of Science. They recommended the substitution of a single organization for the topographic and geologic work, and accordingly in 1877 Congress created the United States Geological Survey (q.v.) as a bureau of the Interior Department. This survey has been continued by annual appropriation (about $1,500,-
00 in 1917). It has made detailed topographic maps of 40 per cent of the area of the United States. Large areas have also been mapped geologically, considerable public land classified in various ways and water resources determined. The maps are on various scales and sold at cost of paper and printing, most of them by the survey. Many of the geological reports are for gratuitous distribution. Two hundred and eleven folios of the Geologic Atlas of the United States have been issued which sell from 25 to 75 cents each.

Reclamation Service.—Many detailed surveys have been made by the Reclamation Service in connection with its various projects, and many suggested ones. Some of the resulting maps have been issued in the various annual reports of the bureau and others are filed.

Isthmian Surveys.—Many surveys have been made by parties sent to the Central America and Panama by the United States government to obtain data for canal routes.

General Land Office.—The General Land Office created in 1812 (see PUBLIC LANDS) and since 1849 a bureau of the Interior Department, has surveyed a large proportion of the public lands in the States west of the Mississippi River, except Texas, and also Ohio, Illinois, Indiana, Florida, Alabama, Wisconsin and Michigan. Many of the State lines were run by the Land Office. In the surveys by this bureau public lands are divided into townships six miles square, comprising 36 sections one mile square, the latter divided into quarter sections of 160 acres and in some cases, minor divisions, a system devised by Lieutenant-Colonel Mansfield in 1803. The enclosing lines are due north and south and east and west and owing to convergence of meridians and varying length of parallels at different latitudes the divisions are only approximate. The townships are numbered east and west from prime meridians, and north and south from standard parallels. The sections, ordinarily a mile square, are numbered thus:

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Thus, for instance, a piece of land is designated NW3/4 Sec. 28, T. 19 S., R. 28 W. New Mexico. Farther subdivision is indicated by ¼, ½ sections, and odd areas as lots. The maps are prepared on a scale of two inches to one mile and in most cases the configuration of the land is represented by hachures excepting in later work in a few Indian reservations where contour lines have been used. This mapping covers most of the smooth surfaced or rolling lands but large areas of mountain lands are not yet subdivided. The maps are issued but held in file in the general land office and local land offices in various public land States. The bureau does, however, issue general maps of the States and of the United States compiled largely from its own surveys.

Coast and Geodetic Survey.—The work of mapping the coast of the United States was initiated by Congress, 10 Feb. 1807, on recommendation of Thomas Jefferson, with an appropriation of $50,000. F. R. Hassler was its first superintendent, beginning work in 1816 and continuing to 29 April 1818 as a bureau of the Treasury Department. The surveys were then continued by the United States army engineers and by officers of the navy until the bureau resumed operations again in 1832 under the Navy Department with Hassler again as superintendent. On reorganization late in 1843 A. D. Bache became superintendent and he continued in charge until his death in 1867. Pierce, Patterson, Hilgard, Thorn, Mendenhall, Dulfield, Fritchett, Tittmann and superintendents. The geodetic work or determination of the form of the earth was made an additional function of the survey in 1878. The survey has prepared charts of the coasts and exterior waterways of the United States and of parts of its possessions, and mapped more or less of the coast, the District of Columbia and other areas. Many special reports on geodesy, tide tables and scientific researches of the bureau have been issued. The charts which are issued in sheets of various sizes and scales are sold at low rates directly by the bureau and by local agents in seaboard cities.

Mississippi and Missouri River Commissions.—The Engineers corps, War Department has made a detailed survey of the Mississippi River and of its principal tributaries, showing topography of the shore, 1876-84. These surveys were intended primarily for guidance in the many engineering problems connected with improving the waters for navigation, a task on which the government has expended over $150,000,000 up to end of June 1916. The War Department has made special surveys for many river and harbor improvement projects.

Hydrographic Office (q.v.).—To this branch of the Navigation Bureau of the Navy Department is entrusted the preparation of many kinds of data relating to navigation. Numerous maps are produced in many cases based on original surveys.

Forest Service.—The Forest Service of the Agricultural Department has made surveys in most of the Forest Reservations in some cases with detailed representation of topography and distribution of various kinds of timber. A series of atlases has been published and many maps are on file in the various offices of the bureau. Some work of this kind was done by the United States Geological Survey in 1897-1900 and many maps were published in annual reports and professional papers. Since 1897 this survey obtains data as to forested areas in all districts mapped geographically.

Soil Surveys.—The Agricultural Department has made surveys of soils in many parts
of the United States, publishing the results on the detailed topographic maps by the United States Geological Survey. These soil maps are issued for gratuitous distribution.

Biological Survey. The Agricultural Department is also conducting a survey to ascertain the geographic distribution of animals and plants.


N. H. DARTON,
United States Geological Survey.

SUSA, soo-sâ, Persia, capital of the province of Susiana or Elam, on the Chaoesp River, 50 miles west of Shushtar, was one of the celebrated cities of the Old World, renowned in Biblical history. Shushtar, meaning lies is, is alluded to in the Old Testament and on cuneiform tablets of Assyria. It has a rectangular form without walls, but possessed a strongly fortified citadel, which enclosed the stately palace and one of the most important treasuries of the Persian kingdom. Numerous rivers water the plain in which it stands, some of which partly surrounded the ancient city. All the Persian kings, beginning with Darius I erected beautiful palaces, the remains of which belong to the most magnificent ruins of Asia. It was the seat of Esther's intrigues, and it was here that Esther's instructions were delivered. Daniel saw the vision at Shushtar, and here he was buried. Consult Billerbeck, 'Susa' (Leipzig 1891); Dihalayou, 'L'Acropole de Susa' (Paris 1888 92); de Morgan, J., 'Fouilles à Susa' (Paris 1900).

SUSANNA, soo-zân'a, the Jewish woman who figures in the book of Susanna, as the intended victim of two elders who obtained her condemnation to death on a false charge. The prophet Daniel proved her to be innocent, and obtained a reversal of the sentence. The date of about 600 B.C. is ascribed to the event. See Susanna, Book of; Bible.


Suspension, in canon law, a censure of which a clergyman is forbidden to exercise his order or to enjoy the fruits of his benefice. Partial suspension inhibits a cleric from the exercise of his spiritual functions, or from the administration of his benefice, or only from a part of his sacred functions: for example, a bishop may be suspended from ordaining, and yet be perfectly free to govern his diocese. Entire suspension prohibits all use of order, jurisdiction or benefice. In the English canon law, as in that of the Roman Catholic Church, a suspension is removed by absolution, by revocation of the censure by the person inflicting it or by dispersion.

Suspension Bridge. See Bridge.

Suspension Railway, a railway in which the carriage is suspended from an elevated cable or track. See Monorail.

Susquehanna, Pa., borough of Susquehanna, on the Susquehanna River and on the Erie Railroad. It is 38 miles north of Carbondale and 23 miles southeast of Binghamton, N. Y. It has machine shops, chemical works and manufactures of washing machines and metal ware. Pop. 3,478.

Susquehanna, süs-kwê-hân'a, a river formed by two branches, an eastern or northern and a western, which unite at Northumberland in Pennsylvania. The eastern branch, which is considered the main stream, issues from Lake Otsego in New York, and has a length of about 250 miles. The western branch rises in the western slope of the Allegheny ranges, and flows very circuitously east-southeast for about 200 miles. The united stream flows south and southeast, passing Harrisburg, Wilkesbarre and Binghamton, N. Y., enters Maryland, and after a course of about 150 miles flows into the northern extremity of Chesapeake Bay. The navigation was much obstructed by rapids, but by constructing canals the river has been made navigable for a considerable distance from the Chesapeake.

Susquehanna Company, The, in American history a land company formed in 1754, chiefly by Connecticut farmers, for the colonization of the Wyoming country. By a treaty with the Five Nations, 11 July 1754, an enormous tract of country was purchased for $10,000. It began at the southern boundary of Connecticut and followed in a northerly direction the course of the Susquehanna to northern Pennsylvania. In 1783-86 many disputes arose between the Susquehanna Company and the Pennsylvania claimants of the territory. This was called the "Pennamite War."

Susquehanna University, a Lutheran institution of higher education at Selingsgrove, Pa., founded in 1858. The faculty numbers 22; the average annual attendance of students is 325; tuition fees are $75 to $90; living expenses, board, etc., $175 to $220; the productive funds amount to $72,000; the total income, including tuition and incidental charges, amounts to $42,000. The college colors are orange-maroon. The library contains over 16,500 volumes. The number of graduates since organization number over 1,000.

Sussistinnako, the Spider, was according to the Sia Indians of New Mexico, the first of all beings in the lower world. He lay out the directions by drawing one line of earth from east to west, and another from north to south. Within the magic confines thus laid out he sang his magic songs and rattled his magic rattle, and as he sang and rattled people, animals, birds and insects appeared at his call. He created two mothers, who were the mothers of all; then he divided the people into clans, after he had created the earth for them, and he made the Cloud People,
ing People, the Thunder People and the People, and he commanded them or the people of Haarts (the earth). The world into three parts: Haarts (upper plain); and to the Clouds (rainbow) he gave the Middle Plain. This had been done he had the two others create the sun, the moon and the night.

SUSTENTATION FUND, the name specified in the Presbyterian denomination fund for the support of poorer All important religious bodies have this character. The object is to en- sure gifts of their own means properly a pastor or minister, to benefit of religious services.

ERLAND, Alexander, Canadian clergyman: b. Guelph, Ontario, 17; d. 1910. He learned the printer’s trade. studied for the ministry and in 1859 died a preacher and stationed at He removed to Therold in 1861 and preached at Drummondville, Ham- Ville, Toronto and Montreal. He was of the Conference in 1870-71, and unior of the Methodist churches in Canada. was secretary and treasurer of the Church. In this capacity he buddy tours of Canada, and in 1879 was a campaign to raise $75,000 for the clearing of the missions depart- ment and success to the work. ‘A Summer in Prairie Land’ (1892).

ERLAND, George, United States clergymen. Buckinghamshire, England, 25 March 1851 came to the United States with his 1864, received his academic educa- tion and studied at the University of in 1882-83. He was admitted to the 83 and engaged in practical at Salt Lake City. He was elected to the Utah Republican party in 1896; served in 1901-03 and in the United States 1905-17.

ERLAND, Howard, United States near Kirkwood, Mo., 8 Sept. 1865. was graduated at Westminster Col- on, Mo., studied law at Columbia (Washington) University, but did not pursue an engineering career. In 1889-90 Mr. Suther- editor of the Republican of Fulton, from 1890 to 1893 served as clerk of population division of the 11th in 1893 he removed to Elkins, W. Va., 10 years he was connected with the in coal and railroad interests, be- fore general agent land. For has engaged in coal and timber land on his own account and is president of the Newbrough Land Company of Valley In 1882 he fought in the wars of the Buddhist story and system. The Christian, T. W. Rhyds Davis, gives the dates of Buddha’s life of 80 years about 500-420 B.C.

SUTTEE, sū-tē’, in India, a term applied to the self-immolation of Indian widows on the funeral pile of their deceased husbands. The origin of this practice is of considerable antiquity, but it is not enshrined by the laws of the great legislator, Manu, nor is it based on the Vedas. This practice was abolished by Lord
Hentince, governor-general of India, in December 1829, and may now be said to be extinct, though perhaps rare cases still occur. Until then the British government had permitted it, perhaps as a protest against the very religious practice of the Hindus (which the religion of Brahma also prescribes), and if notice of such resolution had been previously given to a magistrate, who was required to see that the sacrifice was public and that all the requisite ceremonies were fulfilled. The ceremonialities of a sacrifice were various and lasted from a quarter of an hour to two hours. Sometimes the widow was placed in a caviary prepared under the corpse of the husband; sometimes she was laid by the body, embracing it. If the deceased died at a distance from home, anything which belonged to the deceased — his garments, slippers, walking-staff — might be substituted for the corpse. Consult Bose, J. C., 'The Hindus as they Are' (2d ed. London 1864), and Tylor, E. B., 'Primitive Culture' (4th ed., 2 vols., New York 1903).

SUTTER, John Augustus, American pioneer: b. Kandern, Germany, 15 Feb. 1803; d. Washington, D. C., 17 June 1880. He was graduated at the Bern Military Academy in 1823 and came to America in 1834, locating at Saint Louis. Receiving favorable accounts of California he crossed the Rocky Mountains in 1836; sailed down the Columbia River and thence to Hawaii. After going to Sitka, Alaska, he cruised along the Pacific Coast and was stranded at the site of San Francisco in July 1839. During that year he established the first white settlement on the site of Sacramento. In 1841, after receiving a large tract of land from Mexico, he built a fort which he named New Helvetia on the site of the present Sacramento, Cal.; was made governor of the frontier country by Mexico, but was held in suspicion by the Mexicans owing to his friendly feelings toward the United States. In 1848, when California was ceded to the United States, he owned many thousand head of cattle, much land and other property, but owing to the discovery of gold his estates were overthrown by miners, and his workmen left him, and not being able to secure others he financially ruined. He appealed to the Supreme Court, but was not sustained. Later the legislature of California granted him a pension of $250 a month. He moved to Litz, Pa., in 1873. (See SACRAMENTO, CAL.) Consult Dellenbaugh, F. S., 'Fremont and 49' (2d ed., New York 1914).

SUTTNER, Bertha, Baroness von, Austrian author and worker for universal peace: b. Prague, 9 July 1843; d. Vienna, 21 June 1914. She was the daughter of Count Franz Kinsky, an Austrian field-marshal, who died in her infancy. She was excellently educated, traveled extensively, and in 1876 she was married to Friederich Vitus Gundacar von Suttner, the novelist, who died in 1902. She was for a time secretary to Alfred Nobel, and for the greater part of her life was an indefatigable worker for world peace. She was widely known as a writer of fiction, on social science and on a world union to ensure peace. She was awarded the Nobel Peace Prize in 1918. She wrote: 'Der Mann und Freiheit' (1882); 'Die Waffen nieder!' (1884); 'Hanna' (1884); 'Krieg und Frieden' (1891); 'Schark der Qual' (1891); 'The hanger Friedenskonferenz' (1900); 'When Thoughts Will Soar!' (1914); 'Der Kampf um die Vermeidung des Weltkrieges' (2 vols., 1917); etc. Consult her 'Memoirs' (Stuttgart 1908; Eng. trans., Boston 1910).

SUTTON, Mass., village and township in Worcester County, eight miles southeast of Worcester, on the New York, New Haven and Hartford Railroad. There are manufactures of cotton goods. Pop. town, 2,829.

SUT TUNG PO, or SOO TUNG PO, also known as SOO SHIH, Chinese poet, essayist and statesman: b. 1631-36; d. 1101. He was educated under the care of his mother and passed first on the list when he was examined for his degree. He was at various times the holder of high offices at court, but was several times banished through the jealousy of enemies. He was a brilliant writer of verse and essays, and holds a high place in Chinese literature. Consult Giles, H. A., 'Gems of Chinese Literature' (1884); 'A History of Chinese Literature' (1901).

SUTURE, a line along which two things are joined, as by sewing, etc., so as to form a seam or something resembling a seam. In anatomy a suture is the immovable junction of two parts by their margins. The sutures of the skull are the lines of junction of the bones of which the skull is composed. Various types of suture exist, as the serrated or denitied suture, the squamous or scauly suture and the harmonic suture or harmonia. Arranged according to their situation, there are coronal, frontal, fronto-parietal, occipito-parietal, and many other sutures. In surgery a suture is the uniting of the lips or edges of a wound by stitching. In zoology sutures are the outlines of the septa in the Tetrabranchiata, so named from their resemblance to the sutures of the skull. When these outlines are folded the elevations are called saddles and the intervening depressions lobes. In botany a suture is the line formed by the cohesion of two parts. If the suture formed by the carpellary leaves in a pistil face the centre of a flower it is called the ventral suture; if it face the perianth, the dorsal suture. The former corresponds to the margin and the latter to the midrib of the carpellary leaf. Consult Donaldson, 'Modern Surgery' (7th ed., Philadelphia 1914).

SUVA, soe'vā, the capital of the British colony of the Fiji Islands (q.v.). It is about 1,100 miles distant from Auckland, New Zealand. It has a population of over 1,300 Europeans.

SUVALKI, soo'val'kee, Poland, (1) capital of the province of the same name, on the Garna-Hauka, near the Prussian frontier, 152 miles northeast of Warsaw. It contains two churches, municipal buildings and a large market-place, various schools of primary and grammar grades, two breweries, etc. Pop. about 35,000. The town was taken by the German forces in 1915. (See WARS, EUROPEAN.)

(2) The province of Suvalkis lies in the extreme northeastern part of Poland. In the north is covered by thickly-wooded plains and on the Prussian frontier are forests, swamps and lakes. The fertile soil is rich there also. The chief rivers are the Niemen, Bohr, Schescheupe and Pissia. Agriculture is the principal occupation.
SUROVOROFF-RIMNIKSKI — SVEDRUP

There are numerous factories, including tanneries, distilleries and mills. There are some schools. Area, 4,763 square miles. The population is about 700,000, of whom 50 per cent are Lithuanians.

SUROVOROFF-RIMNIKSKI, soo-rohv-oft rim-myhksk-hee (Prince ITALIAN), a celebrated Russian general: b. in Moscow according to one account, in Finland according to another, 24 Nov. 1729; d. Saint Petersburg, 18 May 1800. He entered the army as a grenadier, was bravely in the war against Sweden and by his distinguished conduct during the Seven Years' War gained the rank of colonel (1762). He participated in the suppression of the Polish uprising of 1768-69, capturing Cracow in the first year of the conflict and attaining the rank of major-general. When war with Turkey broke out in 1773, Suvoroff as general of division achieved notable victories at Turtukai and Hirsuvu, and in conjunction with a force under Kainenski, completed the overthrow of the Turkish army at Kosludji beyond the Danube. Subsequently he fought against the pretender Pugatcheff, whose overthrow was largely due to his exertions, and made successful campaigns in Crimea, against Kazakhs, Kabul, and Kirghiz, and against the mountain tribes of the Caucasus. Upon the renewal of war with Turkey in 1787 he was entrusted with the chief command, and after inflicting decisive defeats upon the enemy at Kishburn, Otrchakov and Teshchani, performed the most splendid feat of arms of the entire war by effecting the rescue of the Austrian army under the Prince of Saxe-Coburg, which was surrounded on the banks of the Rymnik by a vastly superior Turkish force, which Suvoroff utterly overthrew, gaining thereby the title of Rimnikski and the rank of count. In 1790 he stormed Ismail, where his troops were guilty of the most bloody excesses. Sent in 1794 against the Polish insurgents he gained the title of field-marshal by his storming of the Praga, suburb of Warsaw, and the occupation of the Polish capital. After five years of retirement, he was summoned to take command of the Russian forces which were to cooperate with the Austrians against the revolutionary armies of France in Italy. At 70 Suvoroff was to achieve the most notable triumphs of his career. Arriving in Italy in April 1799 he succeeded within four months in driving the French from the northern part of the country, after he had defeated their armies at Cassano, 27 April, on the Trebbia, 17-19 June and at Novi, 15 August. Thereupon he crossed into Switzerland to effect a junction with a second Russian army under Korsakoff. The crossing of the Saint Gotthard pass was accomplished only after fearful hardships, with the loss of one-third of his army and all his guns. In Switzerland he found that Korsakoff had been defeated at Magenta and that the French were masters of the country. He thereupon began a retreat through the Grisons and Vorarlberg, in which he displayed some of the highest qualities of his generalship. Setting out on the way to the Rhine in April 1799, he was in-chief of all the Russian forces with the title of Prince Italieski, he lost the favor of the Emperor Paul before his arrival in Saint Petersburg, where after a short ailment he died. Consult Smith, F., 'Suvorow's Leben und Heerzüge' (Vilna 1833-34); also his 'Auto- biography,' edited by Glinka (1819); and biographies by Polevoi (1853); Spalding (1890). Consult also Macready, E. N., 'A Sketch of Suwarrow and his Last Campaign' (London 1851), and Reding-Biberger, 'Der Zehnte Suworows durch die Schweiz' (Zürich 1869).

SUWANNEE, soo-wahn-ee, a river in southern Georgia, in the Okefenokee Swamp, which flows in a winding, generally south-southwest course through Florida into the Gulf of Mexico, about 10 miles north of Cedar Keys. It is the subject of the popular ballad, 'Old Folks at Home,' beginning "Way Down on the Suwanee River." Its total length is about 240 miles.

SUWARROW, soo-wahr-ow, or SUVAROF, a group of islands in the Pacific Ocean, between Samoa and the Manihiki Islands, is generally included in the Tokelau Islands. It has important pearl fisheries. Great Britain annexed the islands in 1889.

SUYEMATSU, Kencho, VISCOUNT, Japanese statesman, son-in-law of Marquis Hirohumi Ito (q.v.): b. Bunzen, Kiitsu, August 1855. He served in the Satsuma Rebellion as a civilian official in the army under the command of the army officer and later engaged in journalism on the staff of Nichi Nichi. In 1890-95 he was a member of the Japanese House of Commons, and after he was created baron in 1895 he served in the House of Peers. He was director of the Legislative Bureau in 1896-1903, Minister of Communications in the Ito Cabinet in 1898; and held the portfolio of the Interior in the Seiyukai Cabinet in 1900-01. He served as a non-official agent for Japan in London during the Russo-Japanese War in 1904-05. He was made a viscount in 1907. He translated into English 'Genji Monogatari'; and is author of 'The Rising Sun: A Fantasy of Far Japan' (1915).

SUZZALLO, Henry, American university president: b. San José, Cal., 22 Aug. 1875. He graduated at the California State Normal School in 1895, at Leland Stanford Junior University in 1899 and took his Ph.D. at Columbia University in 1905. He was connected with the faculty at Leland Stanford Junior University in 1902-07; was professor of the philosophy of education at Teachers' College, Columbia, in 1909-15; and since 1915 has been president of Washington University, Seattle. He has edited the Riverside Educational Monographs since 1909, has lectured extensively and is a contributor to educational magazines. He was appointed chairman of the Washington State Council of Defense in 1917.

SVEDRUP, svevr-droop, Otto, Norwegian Arctic explorer: b. Harstad Farm, Helgeland, 1855. He went to sea at 17, went with Nansen to Greenland in 1888, and again in 1893, as a commander of the Fram, which he brought back to Norway in 1896. He led an expedition to the northern regions in 1898, with the intention of exploring the north of Greenland. The expedition received its financial support mostly from two himandred individuals, and the Norwegian government renovated and equipped the Fram for his use. On reaching Smith Sound, between Ellesmere Land and Greenland, he found it impossible to force his vessel further north through the ice, and sent
two expeditions to the southwest across Ellesmere Land, which penetrated a region never before explored, and found in the southern part of Ellesmere Land a large glacier district. Later in 1890 he brought the Fram down into Jones Sound, to the south of Ellesmere Land, and from there conducted a number of sledging expeditions, exploring the southern and western portions of Ellesmere Land. On the southeast coast of Ellesmere Land, north of Jones Sound, a large bay was discovered about 100 miles in breadth and penetrating into Ellesmere. On the northern side of this bay large and complicated fords are situated. On the west coast of Ellesmere Land, in about 85° W., a large system of fords was discovered. To the west of Ellesmere Land, about 130 miles north of the Parry Islands, Sverdrup discovered two islands, to the north and west of which nothing was visible but rough polar ice. He returned to Norway in 1902. The discovery of the islands and the mapping of the western and southwestern coasts of Ellesmere Land are the most important results of Sverdrup's expedition. He brought back also a valuable series of meteorological reports, and a large natural history collection. In 1914–15 he led a relief expedition to the Arctic and wintered on the shores of Kara Sea. He published 'New Land: Four Years in the Arctic Regions' (1904).

SVETLA, Karolina, Bohemian novelist: b. Prague, Austria, 24 Feb. 1830. She gained the attention of the literary critics by her first novel 'A Double Awakening,' published in 1858. She has attained high rank in Bohemian literature, many of her novels being translated into French, German, Polish and Russian. Among them are 'Laska k Isakoviči' (1860); 'Yesnicky roman' (1869); 'Kriz a potoka' (1871); 'The Atheist' (1873).

SWABIA, swä'bi-a, or SUABIA (German, Schwaben), capital Augsburg, now part of the republic of Württemberg, formerly a duchy in the southwestern part of Germany, occupying the area now covered by Baden, Württemberg and a part of Bavaria. It extended from the Rhine to the Lech on the east and from Switzerland northward to the Rhine Palatinate. It is a mountainous country, and probably the most picturesque portion of Germany. The region was known in ancient times as Alamannia, and received its present name from the Suevi, who entered it in the 5th century and amalgamated with the Alamanni. In the 10th century Swabia was raised into a duchy which continued in the house of Hohenstaufen until 1268, when it was resolved into a number of lesser principalities among whom there was continual feud. In 1488 these little states formed the famous 'Swabian League' for the purpose of securing internal peace and giving mutual aid to each other. In 1512 the emperor, Maximilian I, made Swabia one of the 10 circles into which Germany was divided, and enlarged its territory. This division continued until 1806, when the modern kingdom of Württemberg was founded. (See BADEN; WÜRTTEMBERG.) At present the name of Swabia is obtained by one of the southern provinces of Bavaria. Consult Stalin, B. F., 'Geschichte-Württemberg' (Gotha 1882–87); Schneider, Eugene, 'Württembergische Geschichte' (Stuttgart 1896). See WAR, EUROPEAN.

SWAGE (swáj) BLOCK, a heavy iron block of any size provided with notches and perforations, used by blacksmiths in shaping metal. The swage block is so arranged that it may be readily clamped in any desired position and may as readily be released whenever it is necessary to adjust the anvil to a different position. The block has tramlines or journals which engage open bearings formed on the top of the standards of the frame. The standards are connected with each other at their lower ends by bolts. Midway of their height they are connected by a clamping device which consists of a rod revolving secured to one standard and threaded into a nut in the other standard. By operating a crank on this rod the upper ends of the standards may be drawn to give an opening to the ends of the swage block and hold it from turning. Inwardly-directed flanges are formed on the standards just below the trunnion bearings, and these on being drawn inward form firm supports for the swage block when in horizontal position. The recesses lying between these flanges receive and securely hold the swage block in its vertical position. When the swage block is held at other angles the flanges sink into grooves formed in the ends of the block around the journals. The usual variety of notches, recesses, perforations, etc., are provided for assisting in upsetting bolts, shaping horseshoes and forming all other devices which a blacksmith may be called upon to make. The construction of this swage block is the extreme of simplicity.

SWAIN, swán, George Fillmore, American civil engineer: b. San Francisco, Cal., 12 March 1857. He was graduated at the Massachusetts Institute of Technology in 1877 and then studied in Berlin, Germany. In 1887 he accepted the chair of civil engineering at the Massachusetts Institute of Technology, where he remained until 1909. He also served as consulting engineer of the Massachusetts Railroad Commission and was member of the Boston Transit Commission and its chairman in 1913. In 1909 he was made professor of civil engineering at the Harvard Graduate School of Applied Science. He is the author of 'Notes on Hydraulics' (1885); 'Notes on Theory of Structures' (1893); 'Report on the Water Power of the Atlantic Watershed' (in Vol. XVII of the 'Tenth United States Census') and 'Conservation of Water by Storage' (1915).

SWAIN, Joseph, American college president: b. Pendleton, Ind., 16 June 1857. He was graduated at the Indiana University in 1883, was assistant professor of mathematics in 1883–86 and full professor, 1886–91. He was called to the chair of mathematics in the Leeland Stanford Junior University in 1891, which he held till 1893, and was president of Indiana University, 1893–1902. Since the last-named date he has been president of Swarthmore College. He is the author of numerous scientific papers. In 1913–14 he was president of the National Education Association.

SWALLOW HOLES. See SINK HOLES.
SWALLOW-TAILED BUTTERFLIES — SWAMMERDAM

SWALLOW-TAILED BUTTERFLIES, butterflies of the family Papilionidae, typical species of which have the hinder wings extended into prolongations called tails. See BURNT-SIDE.

SWALLOWS, a family (Hirundinidae) of passerine birds which are the counterpart in this order of the swifts (q.v.). This family is distinguished by the small, flat, triangular bill which has its sides gradually compressed toward the tip and the deeply cleft mouth, the margins of which are covered with small bristles or none; the nostrils rounded at the base of the bill, either exposed or covered by a scale. The wings are long, while the tail is forked in nearly all species and the outer feathers may be prolonged. The feet, although small and weak, are totally unlike those of the swifts, the hind toe being never versatile, the number of phalanges not different from that of ordinary birds and the squamation normal; sometimes the tarsi and toes are feathered. In striking contrast to the swifts many of the swallows are adorned with rich iridescent colors and sometimes the sexes differ. Anatomically the swallows are truly passerine, but the fissorial bill and mouth, together with their peculiar adaptations for life in flight, makes them one of the most clearly circumscribed and natural families of that order. Owing to the many interesting modifications of the type the genera are numerous and many of them are restricted in distribution; but the more generalized genera, like the typical Hirundo, are, like the family, cosmopolitan. About 100 species have been described. Belonging to the North American fauna are 10 species representing no less than seven genera, most of which are peculiarly American. The barn-swallow (Hirundo or Chelidon erythrogaster) is abundant throughout North America and is easily distinguished by the elongated outer tail-feathers, the lustrous steel-blue color of the upper parts and the rusty breasts. (See BARN-SWALLOW.) The cliff or eaves swallow is colored much like the barn-swallow, but the tail is shorter and only slightly forked; it makes retort-shaped nests outside of barns, etc., under the eaves, as it formerly did on the faces of cliffs.

One of the swallows which retains its original habits is the beautiful white-bellied or tree-swallow (Tachycineta bicolor). It is of a fine lustrous green above, pure white below, with a tail only slightly more forked than in the last. The tree swallow is abundant in most parts of temperate North America, but especially so coastwise where great numbers nest in holes of trees from New Jersey northward. It is one of the first swallows to move northward in the spring and is frequently forced to retreat before a belated snowstorm or cold wave, being, therefore, one of the species to which the common saying, "one swallow does not make a summer," is especially applicable. In the West a related species, the violet-green swallow (T. thalassina), is found. Another interesting member of the family is the bank swallow, which is found in Europe as well as in America. Closely resembling it is the rough-wing.

Biggest, handsomest, jolliest, most domestic of American swallows and ever ready to defend his home is the purple martin (Progne subis), a familiar species throughout temperate North America, distinguished as a genus (Progne) by the strong bill with curved edges, by the moderately-sized forked tail, and by the strong and large feet. The sexes are quite dissimilar, the male being entirely blue black, the female and young, dull sooty gray on the breast. Except in the wilds where it continues to nest in hollow trees, it takes up its abode among the habitations of men. A common practice is to hang up some old water pipes, properly hollowed, for its convenience in nest-building; and in the more settled parts considerable expense is sometimes incurred in preparing for it a suitable residence. The eggs are four to six in number and white. In the country it renders essential services by attacking and driving away crows, hawks, eagles and other large birds. Its note is loud and musical. The regularity with which this species arrives from the South is noteworthy. The western variety is distinct and another species enters the habit.

Of exotic species of swallows the Hirundo rustica takes the place in Europe of our barn-swallow. On account of its frequent use of disused chimneys for nesting places this species shares with the other most popular swallow. The migration of these birds has always attracted attention from the well-known and unvarying character of their movements. They fly southward at the end of October or sometimes sooner, to winter in Africa, some finding their way to India. The majority arrive in Great Britain in April, some stragglers later and a few coming before the great body of birds. They generally return to the nests they have constructed the previous year. The house martin (Chelidon urbica) with the tarsi and toes feathered is of small size. It is of smaller size than the common swallows, and builds its nest under the eaves of houses, in the corners of windows, etc., the nest being a hemispherical structure of clay, with a round opening for entrance. A related species is the fairy martin (C. ariel), found in South Australia, where it arrives in August, leaving again in September or October. The nest, built in some tree, under eaves or in rocks, is formed of mud, and is of flash-like shape. The nest is usually built by a number of these swallows. The wire-tailed swallow (C. riferus) of Abyssinia is so named from the presence of the two elongated tail-feathers, which, being unprovided with a web, consist of the shafts of the feathers alone, and appear as long filaments. The genus Atticora includes the white-breasted swallow of South America (Atticora cyanoleuca), which makes its nest in the deserted burrows of animals. A number of other South American swallows have similar habits, occupying the nests or holes of various birds and mammals.

Consult Sharpe and Wyatt, 'Monograph of the Hirundinidae' (London 1885-94), with bibliography and numerous colored plates; Forbush, 'Useful Birds and their Protection' (Boston 1913); Wilson, 'American Ornithology' (Philadelphia 1828); and recent works on field ornithology.

SWAMMERDAM, sw'am-mér-däm, Jan, Dutch naturalist: b. Amsterdam, 12 Feb. 1637; d. there, 15 Feb. 1680. He was educated for the ministry but turned his studies to the pro-
fession of medicine. He was devoted especially to the study of insects; and his 'General History of Insects' and other works laid the foundations of the modern science of entomology. These works include 'Tractatus de fascione usque Pulmonum' (1667; Allgemeene verhandeling van bloedeloese dierijen) (1669); 'Biblia Natura, sive Historia Insectorum in certas classes Redacta' (1737–38).

SWAMP. See Bog.

SWAMP ANGEL, in the American Civil War the popular name of an 8-inch Parrott gun, so called by the Federal soldiers. It was mounted on a battery constructed on piles driven into the swamp near Charleston, S. C., and was used in the siege of that city. It burst 22 Aug. 1863, and was sent with a lot of old metal to Trenton, N. J. The gun was rescued from its impending fate and set on a granite base on the corner of Ferry and Clinton streets in the city of Trenton.

SWAMP DEER, or BARASINGHA, an East Indian deer (Cervus duvaucelli), about four feet in height, rich light yellow in color, found in large herds in moist situations. The antlers are large, with a long beam which branches into an anterior continuation of the main portion and a smaller posterior one which is bifurcated.

SWAMP GRASS. See Grasses in the United States.

SWAMP HICKORY. See Hickory.

SWAMP LAND GRANTS. The need of reclaiming the swamp and overflowed lands within the territory of the United States was brought to the attention of Congress in the early part of the 18th century. It was not, however, until the Act of 2 March 1849 that Congress made provision for the reclamation of such lands. This Act applied exclusively to the State of Louisiana, and provided that in order to aid the State in the construction of necessary canals and drains to reclaim the swamp and overflowed lands therein the whole of such lands that may be found unfit for cultivation were granted to the State with the proviso that the proceeds of the sales of all such land shall be applied exclusively as far as necessary to the construction of levees and drains for their reclamation.

This was followed by the Act of 28 Sept. 1850 which provided for a similar grant to the State of Arkansas. This act contained a section which extended its benefits to each of the other States of the Union in which such swamp and overflowed lands may be situated.

By the Act of 12 March 1860 the provisions of the Swamp Acts were extended to the States of Minnesota and Oregon which had become the Union since the passage of the Act of 1850. The reasons assigned for these grants were the worthless character of the lands in their present condition, the unhealthful effects of these lands and the enhancement in value of the adjoining government property.

At the time of this legislation it was estimated that the area of lands involved would be about 5,000,000 acres. However, up to 30 June 1918 there had been conveyed to the several States under these grants 64,258,731.04 acres. In addition there have been granted to the States 744,385.23 acres as indemnity for lands which had been disposed of to settlers prior to the time when the several grants became effective and also a cash indemnity in lieu of lands which would otherwise have been granted, amounting to $2,095,466.70. Comparatively small additional claims are coming in under these grants.

In spite of these liberal grants of land and money, the States have not drained the great body of land actually granted and in many cases the proceeds from the sales of the lands have been used for other purposes. The same reasons for reclaiming these lands which formed the original basis for these grants, therefore, still exist and the United States government has in recent years spent considerable sums to aid in the development of plans for the reclamation of small bodies of these swamp lands. There has also been a widespread sentiment that something definite should be done to make these lands available for agricultural purposes as the area of actual swamp land in the United States is estimated at from 75,000,000 to 80,000,000 acres.

SWAMP LOCUST. See Locust.

SWAMP RABBIT, or WATER HARE. See Hares.

SWAMP SASSAFRAS. See Magnolia.

SWAMPSCOTT, swamp'skot, Mass., town in Essex County, on Massachusetts Bay, and on the Boston and Maine Railroad, about 12 miles northeast of Boston and two miles northeast of Lynn. The town contains the villages of Beach Bluff, Mountain Park, Phillips Beach and Swampscott. It is a favorite watering place, and has an excellent beach and good accommodations for transient guests. There are several churches, a town high school, district schools, a public library and several private schools. Most of the inhabitants are employed in Lynn. Pop. 7,345.

SWAN, James, American soldier and author: b. Fifeshire, Scotland, 1754; d. Paris, 18 March 1831. He came to Massachusetts at an early age, became an artillery captain, a member of the legislature in 1778, and was subsequently adjutant-general of the State. He went to Paris in 1787 where he wrote 'Causes qui sont opposées au Progès du Commerce entre la France et les États-Unis de l'Amérique' (1790). He returned to America in 1795 only to go back to France in 1798. In 1813 he was arrested and imprisoned for 15 years for the suit of a German with whom he had had business relations. Among other books of his are 'On the Fisheries' (1784); 'Fisheries of Massachusetts' (1786).

SWAN, John Macallan, English sculptor: b. Old Brentford, 1847; d. 1910. He studied at the Worcester School of Art and the Lambeth Art School and under Gérôme and Frémiet in Paris. In 1885 he received honorable mention at the Salon, and in 1889 he received the silver medal at the Paris International Exhibition. He received the first and second gold medals at Munich and the first class gold medal for painting and the first class gold medal for sculpture at Paris, 1900. Most of his sculptures are studies of animals and in representing the
cat tribe he is particularly successful in giving vivacity and vitality to the rapid sanguine advance of the leopard or tiger. His principal works are 'Leopard Running'; 'The Prodigal Son'; 'Lioness defending her Cubs'; 'Polar Bear Swimming'; 'A Dead Hero'; 'The Jago'; 'Puma and Macaw' (1900); 'Wounded Leopard'; 'Tigers Drinking,' owned by Henry Frick, New York; 'Ceylon Leopards.' In 1905 he was made a Royal Academician. Consult Baldry, 'J. M. Swan, R.A.' (New York 1905).

SWAN, Joseph Rockwell, American jurist: b. Westerville, N. Y., 28 Dec. 1802; d. Columbus, Ohio, 18 Dec. 1884. He removed to Columbus, Ohio, in 1824 and was there admitted to the bar. He was prosecuting attorney in 1830-34, and judge of the Court of Common Pleas (1834-45). In 1834 he became judge of the Supreme Court and 1859 rendered his most important decision. The United States District Court in Ohio had sentenced a prisoner for violating the Fugitive Slave Law. Under a writ from the Supreme Court of the State sought to set aside the sentence, but it was sustained by Judge Swan, who declared that the State could not reverse the decisions of the United States courts. His publications include 'Treatise on the Justices of the Peace and Constables of Ohio' (1836); 'Statutes of Ohio' (1841); 'Manual for Executors and Administrators' (1843); 'Practice in Civil Actions and Proceedings at Law in Ohio and Precedents in Reading' (1845); 'Swan's Pleadings and Practices' (1851); 'Commentaries on Pleadings under the Ohio Code' (1860).

SWAN, Sir Joseph Wilson, English inventor: b. Sunderland, 31 Oct. 1828; d. 1914. He invented the carbon process of making autotypes, and with Woodbury introduced Woodburytype. To him also is due the invention of the dry plate, which has revolutionized photography. His name is, however, best known in connection with a form of incandescent electric lamp devised by him, which was the earliest in date of many of the electric lamps now in use. His other inventions include a miner's electric safety-lamp, and various improvements in photographic printing and electro-metallurgical deposition. He was a knight of the Legion of Honor, and in 1898-99 he was president of the Institution of Electrical Engineers. He was knighted in 1904.

SWAN, a sub-family (Cygnae or Olorida) of the duck family, characterized by great size and length of neck. The swans have the legs (tarsi) short and reticulated, the front toes being strongly webbed, while the hind toe is not webbed, and has no lobe; and theoral region (between the eyes and the bill) is naked.

In the water the swans are the type of grace and beauty of figure, the long arched and flexible neck, the elevated wings, and their buoyancy and skill in turning and gliding over the surface, all contributing toward this effect. On land, however, the very posterior position of the rectrices then is awkward and slow. Unlike the fussy ducks and geese there is a calmness and dignity about the behavior of swans which has always excited admiration and has caused these birds to figure much in poetic literature. Swans are generally quiet birds and some appear to be constitutionally mute. It is also said that some possess the most powerful and sonorous voices, though none of the musical ability attributed to poets to their death song. These great vocal powers are due to the sounding apparatus developed by the coiling of the gular and in some cases the sternum, much after the fashion of the same organ in certain cranes (q.v.). Not over 10 clearly marked species of true swans are known the world over and nearly every part of the world has its one or more. These birds are strong of wing and wide ranging. No species, however, breeds in Africa. They are arranged in four or five genera.

The North American swans belong to the genus Olor, distinguished from the typical Cygnus by purely technical characters. The two species, the whistling swan (O. columbianus) and the trumpeter swan (O. buccinator) are much alike in appearance, being chiefly white, but the latter is the larger, attaining a length of five feet and a spread of eight feet. The tail contains 24 quill feathers, whereas the whistling swan has but 20. The former is the more widely distributed and the one usually seen on both the Atlantic and Pacific coasts, while the trumpeter swan is most characteristic of the Mississippi Valley, up and down which it migrates, breeding in the upper parts and wintering along the Gulf coast. The whistling swan breeds only in the far north entirely beyond the limits of the United States. It winters in considerable numbers in Chesapeake Bay and the sounds of North Carolina. They associate with wild geese and like these feed largely upon water plants. The account of their large size they are considered great prizes among gunners, but the younger birds, distinguished by the duskyness of their plumage and their less brazen voices, are preferred for table use. The nests are on the ground and are lined with dried grass and down. The two to five eggs are about four and are long and of a yellowish-white color. Except for the differences resulting from its distribution and fresh-water habitat the habits of the trumpeter swan are essentially similar.

The common domesticated or achaten, mute swan (Cygnus olor) is a native of Europe, Asia and Africa. Those of Great Britain are all of the introduced domesticated variety. The swan has, from a very early date, been especially protected both legal and regal interference. In Henry VII's reign the theft of a swan's egg was deemed an offense punishable by a year's imprisonment; and the theft of a swan itself was very severely punished. Swans at a prior date were declared to be exclusively "royal" or "king's" property; and no subject was entitled to hold possession of these birds, save under special favor from the sovereign. To such subjects as possessed the permission to keep swans a special "swan" mark was attached, and this mark was cut on the bill of the birds as a distinctive badge of ownership. The process of marking is known as "swan-upping" or "hopping," and the ceremony in the Thames on the part of the Crown and of the Dyer's and Vintners' Company takes place on the first Monday in August. At the present time but few swaneries remain, but in some places cygnets are carefully raised and bred for the market, and a few of these birds are kept for...
ornamental purposes in most large parks. Several other wild species occur in the Old World and one true swan in South America. The black swan (Chenopeis atrata) is an Australian species, first discovered in 1868; the general plumage is black, the bill being deep red, the primary wing-feathers white and the trachea does not enter the sternum. It is well known in the United States as an ornamental bird. Consult Beebe, C. W., 'The Swans' (in 'Tenth Annual Report of the New York Zoological Society,' New York 1906); Stejneger, 'Proceedings U. S. Nat. Mus.' (Washington 1882); Newton, 'Dictionary of Birds' (Vol. IV, London 1896); Grinnell, 'American Duck Shooting' (New York 1901).

SWAN, Knight of, according to a legend of the lower Rhine, a knight who comes from an unknown country in a boat drawn by a swan, delivers a prince's daughter from her hated suitor and marries her himself, and afterward is obliged to leave her since in spite of his forbidding her to do so she inquires and loves her. Godfrey de Bouillon is the hero of the story. This version is followed by the unknown author of the tale 'Lohengrin'; while Conrad of Würzburg in his poem, 'The Swan Knight,' places the incident in the days of Charlemagne, Consult Hagen, 'Die Schwanensage' (1845); Müller, 'Die Sage vom Schwanen'; Jaffray, 'Two Knights of the Swan' (New York 1910); Newell, W. W., 'Legend of the Holy Grail' (Cambridge, Mass., 1902).

SWAN, Order of, an order of knighthood created in 1440 by the Elector Frederick II of Brandenburg. Its headquarters were in a monastery on a hill near Brandenburg and in Ansbach. It was composed of members of the nobility and its object was to encourage more enthusiastic homage to the Virgin Mary, and perseverance in works of mercy. The order was abolished at the time of the Reformation, but was revived by Frederick William IV of Prussia 24 Dec. 1843 in the form of a free association of men and women of all ranks and creeds for the purpose of alleviating the moral and physical misery of others. Consult Hanle, 'Urkunde und Nachweise zur Geschichte des Schwanenordens' (1874).

SWAN MAIDEN, The. See Valkyries.

SWAN RIVER. See Australia, West.

SWANEVELT, swân'-fâlt, Hermann, Dutch painter: b. Woerden, 1618; d. Rome, 1690. He set out for Italy when very young, carefully studied the scenery of its beautiful districts and, captivated by the pictures of Claude Lorraine, became a scholar of this famous master. He equaled, or perhaps surpassed, his master in his figures both of men and animals, and was always held in highest esteem among the greatest landscape-painters. His etchings, 116 in number, partly of subjects of his own invention and partly of actual scenery, are very much admired. His pictures, even during his lifetime, brought very high prices.

SWANK, James Moore, American economist: b. Westmoreland County, Pa., 12 July 1832; d. 21 June 1914. He founded the Johnstown Tribune, 1853; was chief clerk Agricultural Department, 1871-72; secretary American Iron and Steel Association 1873-85. He is also the author of 'History of Iron in all Ages'; 'Iron Making and Coal Mining in Pennsylvania,' and over 50 tracts on the tariff question.

SWANSEA, swân'-sâ, or ABERTAWE, Wales, an important seaport, capital of the county of Glamorgan, on the right bank of the river Tawe, at its mouth in Swansea Bay, 15 miles west-northwest of Cardiff. The town contains a fine town-hall with a Corinthian façade; the Royal Institution of South Wales, including a library, museum, etc.; a large building in which are housed the public library, art gallery and schools of science and art; a grammar, technical and other schools; the general hospital, a deaf and dumb institution, a blind asylum, etc.; remains of an ancient castle dating in its present form from the 16th century, though first built in 1399; a market, and a harbor.

The harbor is an excellent one with ample modern docks. The staple industries are the smelting and refining of copper, gold, silver and pyrites, which are imported for the purpose from many countries, the manufacture of tin-plate and the working of iron, steel, zinc, nickel, lead and other metals. Chemicals, patent fuels and alkali are also made in considerable quantity, and there are flour-mills, shipbuilding yards, etc. Swansea is also a leading seaport, its imports average annual value $22,000,000, being chiefly the raw material for its metallurgical industries, wheat and other grains, sugar and timber; and its exports average annual value $30,000,000, mainly coal, coke and patent fuel, iron and iron and steel manufactures, wrought and unwrought copper and chemical products (dyestuff, sulphate of copper and carbide of calcium). The vessels annually at the port have an average total tonnage entered and cleared of about 3,800,000 tons. Swansea has municipal tramways worked by electricity, and the town is served by the Great Western, London and North-Western, Midland and some local Welsh railways. The first charter of the borough was issued to King John, and subsequent charters were conferred by Henry III, Edward II, Edward III and Cromwell. The copper industry of the town began to attain importance early in the 19th century, and since about 1830 the town has rapidly advanced in consequence of the development of this and other industries. Pop. 114,663.

SWANSON, Claude Augustus, American senator: b. Swansville, Va., 31 March 1862. He was graduated at the Randolph-Macon College in 1885 and at the University of Virginia in 1886, afterward engaging in law practice at Chatham, Va. He served in Congress as a Democrat in 1893–1905, when he resigned after re-election, and in 1906–10 he was governor of Virginia. In 1910 he was appointed United States senator to fill the unexpired term of John W. Daniel, and was subsequently elected to that office for the terms 1911–17 and 1917-23.

SWANTON, John Reed, American ethnologist: b. Gardine, Me., 19 Feb. 1873. He was graduated at Harvard University in 1896, later
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studied at Columbia University and took his Ph.D. at Harvard in 1930. He has been ethnologist of the Bureau of American Ethnology, Washington, since 1900. Author of 'Contributions to the Ethnology of the Haida' (1905); 'Haida Texts and Myths' (1905); 'Social Conditions, Beliefs and Linguistic Relationship of the Tinglit Indians' (1904-05); 'Tinglit Myths and Texts' (1909); 'Haida' (1911); 'Indian Tribes of the Lower Mississippi Valley and the Adjacent Coast of Mexico' (1911). He is joint author of 'Dictionary of the Biloxi and Ofo Languages' (1912); 'Anthropology in North America' (1915), etc.

SWARTHMORE (swárt'mórr) COLLEGE, located at Swarthmore, Pa. It was founded by the liberal (or Hicksite) body of the Society of Friends, and was first opened in 1869. The main building was destroyed by fire in 1881, but was immediately rebuilt. The college now confers regularly but one baccalaureate degree, that of A.B. This was the original custom until 1874, when the practice of conferring degrees of A.B., B.S. and B.F.A. and the special degree of bachelor of science in civil engineering was adopted; in 1903 the college returned to its first practice. Courses in engineering and mechanic arts are offered, and provision is made for a special course leading to the degree of bachelor of science in civil engineering. The A.B. course includes certain prescribed studies, one major study in any one department in which three full years of college work must be completed, and electives to complete the required number of hours. The prescribed studies include English, Bible study, history or economics, at least one language and one science, and mathematics, or engineering. In the departments of biology, chemistry and physics courses are planned to prepare for the study of medicine. The degrees of master of arts and civil engineer are conferred for graduate work. Swarthmore has been from the first a coeducational college, being the second institution east of the Allegheny Mountains to offer instruction to men and women on absolutely equal terms. Though it is a small college, and not a university, it is especially well equipped for an institution of its size, especially in the science and engineering departments. It has a campus comprising more than 200 acres, bordered by the gorge of Crum Creek, and including the farm on which Benjamin West, the artist, was born. The chief buildings are Parrish Hall (the main building), Science Hall, the observatory, the two gymnasiums, the president's house and residences of the professors, Wharton Hall (a new dormitory). There are two fellowships and 17 scholarships. The productive funds amount to about $1,600,000 and the annual income to $170,000, the library contains 35,000 volumes, including the Friends' Historical Library. The students number 450 and the faculty about 50.

SWATISTIKA, a symbol of the sun in the nature-religions of Aryan races from Scandinavia to Persia and India; and similar devices occur in the art of the Mexicans and Peruvians, and on objects exhumed from prehistoric burial mounds within the limits of the United States. The Swastika consists of a Greek cross, either enclosed in a circle the circumference of which passes through its extremities or with its arms bent back thus Ω, and it is found invariably associated with the worship of the Aryan sun-gods (Apollo, Odin), it is believed to represent the sun. Consult d'Alviella, Eugène Goblet, 'La migration des symboles' (Paris 1891); de Milloué Léon, 'Les schémas' (in Annales du Musée Guimet, Vol. XXXI, Paris 1909);Wilson, Thomas, 'The Swastika, the Earliest Known Symbol and its Migration' (in United States National Museum, Annual Report, 1894, Washington 1895).

SWAT, sóát, India, a territory or district of the Northwest Frontier Province, occupying the valley of the Swat River, north of Peshawar and south of Chitral. It was well known to the ancients, but seldom visited by Europeans until the uprisings of the frontier tribes in 1895. It is a narrow valley between lofty mountains, and inhabited by industrious, liberty-loving Afghan tribes. Pop. about 40,000.

SWATOW, sów-tow', China, a treaty port in the province of Kwang-tung, situated at the mouth of the Han River, 175 miles northeast of Hongkong. The total trade of the port amounts to nearly $34,000,000 annually. The imports are sugar, tobacco, cloth and fruits. The port was opened to foreign trade in 1858. The imports reach annually the sum of about $30,000,000, and the exports to $11,000,000. Pop. 65,000.

SWAYNE, sóán, Noah Haynes, American jurist: b. Culpeper County, Va., 7 Dec. 1804; d. New York, 8 June 1884. He was admitted to the bar in 1823; settled in Coshocton, Ohio, in 1825; and was prosecuting attorney of the county in 1826-29. In the latter year he became a Democratic member of the legislature. He was United States district attorney for Ohio in 1831-41. He was an associate justice of the United States Supreme Court in 1862-81. In the latter year he resigned owing to advanced age.

SWAZILAND, swá-zé-lánd, South Africa, a native state between the Drakensberg and Lobombo ranges, on the borders of the Transvaal. Its surface is mountainous but fertile, and it is thought to contain rich gold and coal deposits. It possesses wide prairies, with latter fine pasturage, especially in winter. There are also extensive forests which contain fine timber—a rarity in South Africa. Water is plentiful, the climate is healthful. The Swazis are a Zulu tribe and were subject to the intrigues of Great Britain and the Transvaal. The Boers obtained supremacy in 1895, which passed with their conquest and annexation by England in 1902. Authority passed to the high commissioner of South Africa in 1906. The Roman-Dutch law is in force. The British resident commissioner is located at Mbabane. Area, 6,536 square miles. Pop. 107,117.

SWEABORG, svá'-bérg, or SVEABORG, Finland, a fortress and naval arsenal, three miles southeast of Helsingfors, which it defends, on a series of islands in the Gulf of Finland. The site of an ancient Norwegian fort, the fortification was erected by the Swedes in 1662 to entitle the islands "The Gibraltar of the North." The principal works occupy five islands which are connected by bridges. The island of Borgo contains the chief military departments, arsenal and school of marines; the
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shipping docks hewn in solid rock, powder magazine and the monument to the Swedish Field-Marshal Ehrensvärd, who erected the fortifications. The strongest fort stands on the island south from here and is called Gustavsvard. Sweaborg was taken by the Russians in 1808; in 1855 it was bombarded by the French and English allied troops. After the revolution in Russia in 1917 Sweaborg was taken by the Finnish and upon the establishment of Finland as an autonomous state it was incorporated therein. Civil pop. about 1,000.

SWEARING, Profane, the use of oaths in a light and familiar manner by way of asseveration or emphasis. As popularly understood, profane swearing involves also many terms of a gross and obscene character. Profane swearing and cursing are made punishable in England by the Act of 19 Geo. II., ch. xxi., which prescribes a graded tariff of penalties for offenders according to their social rank: for each profane oath or curse a laborer, soldier or sailor incurs a penalty of a shilling; other persons under the rank of gentleman two shillings; a gentleman or any one above that rank, five shillings. In several of the States of the American Union profane swearing is variously declared punishable by the statutes. See BLASPHEMY.

SWEAT. See Perspiration.

SWEATMEN, Arthur, Canadian Anglican archbishop: b. London, England, 19 Nov. 1834; d. Toronto, Canada, 24 Jan. 1909. He studied at the University of London and was graduated at Cambridge University in 1859. He was ordained priest in 1860 and in 1865 he removed to Canada where he became head master at Hllemuth Boys' College, London, Ontario, a position he occupied in 1865-72 and 1874-76. He was chaplain to the bishop of Huron, and secretary to the Synod of the diocese of Huron in 1872-79, and held other offices in the Church. He became canon of the cathedral at London, Ontario, in 1875 and was made archdeacon later in that year. In 1879 he was appointed bishop of Toronto, and in 1907 he became archbishop, metropolitan and primate of all Canada.

SWEATING SICKNESS, a febrile epidemic disease of extraordinary malignity which prevailed in Europe, particularly in England, at different periods toward the end of the 15th century and the beginning of the 16th. It appears to have spared no age nor condition, but is said to have attacked more especially persons in high health, of middle age and of the better class. Its attack was very sudden, producing a sensation of intense heat in some particular part, which heat afterward overspreads the whole body, and was followed by profuse sweating, attended with insatiable thirst, restlessness, headache, delirium, nausea, an irresistible propensity to sleep and great prostration of strength. The patient was frequently carried off in one, two or three hours from the eruption of the sweat. It seems to have first appeared in the army of the Earl of Richmond upon his landing at Milford Haven in 1485, and soon spread to London. This body of troops had been much crowded in transport vessels, and was described by Philip de Comines as the most disorderly that he had seen, and that he had collected probably from jails and hospitals, and buried in faith. It broke out in England four times after this, in 1506, 1517, 1528 and 1551. The process eventually adopted for its cure was to promote perspiration and carefully avoid exposure to cold. The violence of the attack was generally subdued in 15 hours. The disease was endemic in parts of Picardy, France, and in Italy, being known in the latter country as military fever. In 1906 there was an epidemic in France. It appears to be allied to influenza. Compare the epidemic of the latter disease with the armies operating in Picardy in 1918, whence it spread throughout the world. Consult Hecker, J. F. K., 'Epidemics of the Middle Ages' (London 1859) and Osler, W., 'Modern Medicine' (Philadelphia 1914).

SWEATING SYSTEM. See Factories and Factory Inspection; Factory System, The.

SWEDEBERG, svä'd-bär', afterward SWEDENBORG, své'd-nborg, Swed. svä'd-nborg, Emanuel, Swedish theologian: b. Stockholm, 29 Jan. 1688; d. London, 29 March 1772. His father, Jesper Sweedborg, was a chaplain and court-preacher to the king. In 1712 Sweedberg's paternal ancestors had been opulent miners in the province of Dalcarlia, and it is also claimed that the heroic blood of Engelbrecht, who liberated Sweden from Denmark in 1434, flowed in his veins. On the side of his mother, Sarah Behm, he descended from Gustavus Wasa, king of Sweden from 1523 to 1560. The name "Sweedberg," as well as Swedenborg, which was given to the family later when they were ennobled, was derived from "Sweden," by which name the homestead was called, and which means a clearing in the forest made by fire.

About all that is known of Swedenborg's childhood and early youth is contained in his autobiographical statements made in two letters, one to Dr. G. A. Beyer, a celebrated clergyman of Sweden, the other to Rev. Thomas Hartley, of the Established Church in England. In the former he writes: From my fourth to my 10th year I was constantly engaged in thought upon God, Salvation and the spiritual ills of mankind; and several times I revealed things at which my father and mother wondered; saying, that angels must be speaking through me. From my sixth to my 12th year I used to delight in conversing with clergymen about faith, saying that the life of faith is love, and that the love which imparts life is love to the neighbor; also that God gives faith to every one, but that those only receive it who practise that love. I knew of no other faith at that time, than that God is the Creator and Preserver of Nature, that he imparts understanding and a good disposition to men, and several other things that follow therefrom. I knew nothing at that time of that learned faith which teaches that God the Father imputes the righteousness of his Son to whomsoever, and at such times, as he chooses, even to those who have not repented and have not returned their lives. And had I heard of such a faith, it would have been then, as it is now (1769), above my comprehension.

In the second letter he says: *In the year 1710 I went a tramp of the inland parts of England, and afterward to Holland, France and Germany, and returned home in the year 1714.
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In the year 1716, and also afterward, I had many conversations with Charles XII, king of Sweden, who greatly favored me, and the same year offered me an assessorship in the College of Mines, which office I filled until the year 1747, when I resigned it, retaining, however, the official salary during my life. My sole objection to my resigning was that I might have more leisure to devote to the new office to which the Lord had called me. A higher post of honor was then offered me, which I positively declined, lest my heart should be inspired with pride. In the year 1719, I was ennobled by Queen Ulrica Eleanora, and named Swedenborg; and from that time I have taken my seat among the nobles of the rank of knighthood, in the triennial Diet of the Realm. I am a Fellow and Member, by invitation, of the Royal Academy of Sciences in Stockholm; but I have never sought admission into any literary society in any other place, because I am in an angelic society, where such things as relate to heaven and to hell, and the spiritual sense of the Word, interest me more than the subject of discourse; while in literary societies the world and the body form the only subjects of discussion. In the same letter he speaks of his special mission as follows: "I have been called to a holy office by the Lord Himself, who most mercifully appeared before me, His servant, in the year 1743; when He opened my sight into the spiritual world, and enabled me to converse with spirits and angels, in which state I have continued up to the present day (1769). From that time I began to print and publish the various arcana that were seen by me or revealed to me, concerning Heaven and Hell, the state of man after death, the true worship of God, the spiritual sense of the Word, besides many other important matters conducive to salvation and wisdom. The only reason of my journeys abroad has been the desire of making myself useful, and of making known the arcana that were entrusted to me. Moreover I have as much of this world's goods as I need, and I neither seek nor wish for more."

In the year 1709 Swedenberg finished his studies at the University of Upsala. In September 1710 he went to London, where for two years he studied astronomy, chemistry, physics, mathematics and other sciences. Then he journeyed through Holland to Paris and after a full year of studies and researches there proceeded to Germany in pursuit of knowledge at the universities, returning to Sweden in 1715.

During the following five years Swedenberg wrote 21 separate treatises and works on various scientific and practical subjects. Among these were descriptions of his own discoveries and inventions in science and the mechanical arts, as the construction of air-pumps, ear-tubes, flying machines, improvement in mining and smelting ores, the building of sluices and canals, the nature of fire and color, the manufacture of salt, the regulation of the coinage, and various astronomical, geological and mathematical subjects, besides an important and original little work on 'Tremulation,' being a theory of sensation in the human body. Up to this time Swedenberg had written in Swedish for the most part, but afterward all his works were published in the Latin language.

In 1719, as above mentioned, the family was ennobled and took the name Swedenborg. In 1721 Emanuel Swedenborg set forth again on a Continental tour of 15 months, publishing the same year at Amsterdam treatises on 'Chemistry,' on 'Iron and Fire,' and astronomical and mechanical subjects. At Leipzig in 1722 he published his 'Miscellaneous Observations on Natural Things.' Having returned to Stockholm he devoted the next 11 years to his duties in the College of Mines, his office in the Diet, and in elaborating a great work on the theory of creation or cosmogony which he published at Leipzig in 1734 while on a third foreign journey. This treatise, the 'Principia,' forms Part I of his 'Philosophical and Metallurgical Works,' of which Parts II and III treat of 'Iron' and 'Copper' respectively. The same year he published 'Outlines of a Philosophical Argument on the Infinite,' etc. The next year was devoted to duties at home, and the preparation of an extraordinary work on the 'Brain.' In 1736 he left Sweden for a fourth time, traveling by way of Hamburg and Amsterdam to Paris, where he remained the following year, proceeding to Rome in 1738. The next year he returned to Paris and in 1740 published at Amsterdam the 'Economy of the Animal Kingdom, Part I.' The next year he published at the same place the second part of this remarkable work on the composition, esence and circulation of the blood; the arteries and veins, the heart and brain; the circulation in the fœtus, etc. Swedenborg's ruling aim and end in all his work now was to discover, if possible, the soul. Says he: 'Bending my course inward continually, I shall open all the doors that lead to her, and by Divine permission, contemplate the soul itself.'

'The Animal Kingdom,' a great work elaborating still further a rational and philosophical view of human anatomy, was published in The Hague in 1744. It is notable that many of the doctrines in these books, discoveries and conclusions original with Swedenborg, have since been confirmed by modern investigation, but the honor has been attributed to them. Such speculations may be mentioned, the true office of the lungs; the animation of the brain, and of its coincidence, during formation, with the systole and diastole of the heart, and after birth, with the pulmonary respiration; the vitality of the blood, etc.

In 1745 appeared at London his 'Worship and Love of God,' the last of his publications previous to the opening of his spiritual sight, when he became a seer and revelator. He records three manifestations of the Lord to him calling him to his new office. The first was in 1743 in Amsterdam during a 'preternatural sleep.' The second was at Delft in Holland in 1744 when, as he says, the Lord manifested himself in person and spoke with him. "It was a countenance with a holy expression, and such that it cannot be described; it was smiling, and I really believe that his countenance was such during his life upon earth;" the third appearance of the Lord to him, Swedenborg relates, was in 1745 in London when the Lord manifested himself again in person, commissioning Swedenborg and calling him to the office of revealing the Doctrine of the New Jerusalem. "From that time I," he writes, "I gave up the study of all worldly science and labored in spiritual things, according as the Lord
commanded me to write." Then followed two years of preparation and illumination before he may be said to have been gifted with a full state of inspiration and a perception of the inmost or celestial sense of the Word. From 1748 to 1750 the 'Arcana Coelestia' in eight vols., quarto, was published in London. This work, the first of Swedenborg's Theological and Religio-physical series, sets forth the internal sense of Genesis and Exodus as it was revealed to him, he declares, immediately by the Lord alone. Then followed (1758) 'Heaven and Hell,' describing the spiritual world and the life of man after death, as well as the happy state of the blessed as the miserable lot of the infernal. In the same year appeared 'The White Horse'; 'The Earths in the Universe'; 'The Last Judgment'; 'The New Jerusalem and its Heavenly Doctrine.' During 1757-59 Swedenborg was engaged upon an explanation of the spiritual sense of the Apocalypse, which work he left uncompleted after writing 1,992 pages. It was published in 1785-89. 'The Last Judgment' describes that event itself which, as he testifies, Swedenborg witnessed in the spiritual world in 1757. 'The New Jerusalem and its Heavenly Doctrine' teaches that the New Jerusalem means the New Church now being established both in the natural and spiritual worlds, the doctrine of which is called Heavenly because it is received by angels and will be received on earth by men of angelic minds. In 1763 appeared 'The Four Doctrines of the New Jerusalem: The Lord, The Sacred Scripture, Life and Faith,' which as revealed in the Word are fundamental teachings of the Church; and 'The Divine Love and Wisdom' treating of the Lord as the Sun of heaven, the Creator of the Universe; of the nature of the Divine and its method and order in bringing ultimate finite and human creatures into existence and being. In 1764, 'The Divine Providence,' was published, showing how the created universe is perpetually sustained and setting forth the laws of God by which he governs man in even the least things of his life to eternity. 'The Apocalypse Revealed' (1766), discloses the internal and external senses of the Apocalypse or 'Revelation,' describing the New Jerusalem as to its quality of life among all those who receive the Heavenly Doctrine in this world and by obedience to its teachings are inaugurated by the Lord into his New Church. 'Delights of Wisdom Concerning Conjugal Love' (1767-68) setting forth the laws of spiritual and eternal marriage which must exist between the souls of wedded consorts. 'Disclosing the Insanities and Horrors of Adultery together with a prescription of laws for the preservation of the conjugal quality in the mind, in the heart and in the life of the man who is unmarried but who regards marriage as a heavenly and blessed estate and condition. The Brief Exposition of the Doctrine of the New Church' (1768-69) wherein is shown the utter variance of the theological dogmas prevailing throughout what is known as the Christian world, both in the Roman Catholic and Protestant churches, from the genuine doctrine of the Scriptures. In the preparation of this work Swedenborg had especially in view the doctrine of the Christian church and he distributed the book to them and to theological semi-naries in Europe. The last and crowning prize of this series of philosophical and doctrinal works is 'The Internal Sense of the nature of the Spiritual Worship in True Christian Religion or the Unveiling of the New Church' (1771) book is presented a general view of the internal sense of the New Church, together with wonderful accounts of it and heard in the Spiritual World Swedenborg as a witness thereof. Among the writings of Swedenborg since his decease may be mentioned 'The Spiritual Diary' (1748), prising a chronicle in the form of persons and things in the Spiritual World, memorable for one reason or another either met or was in some way connected on account of his mission.

In another posthumous little work called Consumption of the Age, etc., S. explains that now is the end of the Church, the Second Advent of the Saviour, the beginning of the New Church, which is to be established by the New Jerusalem and its Heavenly Doctrine. Swedenborg, the New Jerusalem and its Heavenly Doctrine" by (New York 1858) - Swedenborg: His New Age (Philadelphia 1910) - R. W. Swedenborg, or the Mystic" (London 1903) - Trobridge, George. 'Life of Swedenborg.' (Boston 1913) - Berrine, 'Balzac and Swedenborg.' (Biblidgod Documents concerning Swedenborg's Life and Work, 1906) - Stroh, A. H., 'Abridged List of Works of Emanuel Swedenborg.' (Upsala 1910.) Edition de luxe issue Swedenborg Royal Academy of Sciences, Sweden, or Sveriges, a northern European state, forming a united kingdom, occupying the peninsula known in ancient times as Scandinavia. Sweden is between lat. 55° 20' N. and 69° 20' N.; and long. 24° E. and 21° E.; and is bounded on the north by Norway; southwest by the Skag-Ra-gat and Sound; south by the Baltic; east by the Gulf of Bothnia; and by the Torne and its affluent. The area is estimated at 173,035 sq. miles, of which 3,200 are occupied by the last.
the population in 1917 was estimated at 5,757,566, of whom 2,817,950 were males and 2,939,616 females. The average density is 33.3 per square mile. The largest cities in the country are, in order of population, Stockholm, with 1,118,823 inhabitants; Göteborg, 191,535; Malmö, 35,783; Norrköping, 55,623; Kalmar, 35,783; Gävle, 36,623; Orebro, 34,453; Eskilstuna, 30,111, and Karlshamn, 28,556.

Between 1860 and 1916 the town population had risen from 434,519 to 1,617,116, showing an increase of from 11 per cent of the total population of Sweden in the first-named year to 28 per cent in 1916; and between 1840 and 1910 the number of persons dependent on commerce and industry had increased from 108,501 to 453,39 per cent. At the present time the proportions are about equal.

**Topography.**—The coast-line, above 1,400 miles in length, is serrated rather than deeply indented; it is broken by many small inlets, having neither the width nor the tortuous length by which the fjords of Norway are characterized. The west coast is very rocky, and not seldom rises so high as 30 feet. Along the south and southeast coast low shores alternate with precipitous cliffs, which, however, are of no great elevation. As above stated many islets are scattered near the shores, and these where they form the archipelago of Stockholm are especially numerous. The whole of the upper part of the shore of the Gulf of Bothnia consists of sandy alluvial deposits, which are brought down by the rivers in such quantities that they seem destined at no distant period to convert a large portion of the gulf into dry land. It would appear, however, that alluvium is not the only agent employed in carrying on this process of shallowing, since it has been proved that the whole coast of Sweden is continually rising, the rise being greatest in the north.

The interior of Sweden is by no means generally mountainous, and its surface has far less of a highland than of a lowland character. The most elevated portion of it commences in the west near the parallel of 62°, and is continued north along the frontiers of Norway, not so much in a continuous chain as in isolated mountain-masses rising from an elevated table-land, which, where loftiest, is at least 4,000 feet, and forms the base of several summits which rise more than 6,000 feet above sea-level, and owing to their high altitude are covered with perpetual snow. Sjuhäradsberget and Kebnekaise, both in Swedish Lapland, attain a height of about 7,000 feet. Other lofty peaks are Sulitjelma and Sylffjellen, between lat. 63° and 67° on the Norwegian frontier. These mountains and their table-land slope east toward the Gulf of Bothnia, sending down numerous torrents, which in their course often expand and form chains of lakes and dreary swamps. The same slope is continued to the south of 62° N., but beside it there is a south-southwest slope of its level near lat. 59° N., on the shores of the magnificent lakes which there stretch almost continuously across the country east to west. To the south of 59° N. the country is generally flat, though in many parts finely diversified. This region has several fertile and well-cultivated tracts, but a good deal of it is covered by barren sand or stunted heaths, though recorded births numbered 121,214; deaths, 77,683; and marriages, 35,156. The same year 10,571 persons emigrated, 7,208 going to the United States. The recent increase in population chiefly affected the larger cities. In 1917 they are, in order of population, Stockholm, 1,118,823 inhabitants; Göteborg, 191,535; Malmö, 35,783; Norrköping, 55,623; Kalmar, 35,783; Gävle, 36,623; Orebro, 34,453; Eskilstuna, 30,111, and Karlshamn, 28,556.

**Hydrography.**—The rivers and lakes are numerous, the latter in particular on a large scale, giving to the scenery of the country several of its grandest features. The rivers all belong to the basins of the Baltic Sea and the German Ocean. The former receives the far larger share. To it belongs the Tornè, which, rising in the Norwegian mountains, pursues its course south-southeast for nearly 290 miles, augmented by numerous large affluents, and falls into the north arm of the Baltic Sea at Flisund just before the entrance of the Baltic. The Tornè, together with its chief tributaries, the Vete, the Fjäll, and the Skellefteå, is joined by the Viskas and the Umeå at Härnösund, and the headwaters of the Swedish part of the Tornè are united at Suntio, near the entrance of the Baltic Sea. The next in size to the Tornè is the Vänern, which flows 200 miles, and the lower 50 miles of it is navigable by river steamers. The longest and most important of the rivers on the west side of Sweden, the Västra, flows 388 miles, and is navigable below a city. The Vistula, the longest river of Sweden, enters the Baltic at Dalsland, 20 miles west of Stockholm. The largest lake is Lake Vänern (area, 2,014 square miles); the next in size Lake Vättern (821 square miles). Lake Mälaren, better known than the other large lakes, from having the capital on its shores, is also remarkable for the number of islands which so crowd its surface that it is scarcely possible to find a square mile of open water. Hjelmarn, which has both a natural and an artificial communication with Lake Mälaren, has an area of 188 square miles.

**Geology and Minerals.**—The mines of Sweden are rising in importance as rapidly as new mining machinery is being introduced. In 1916 they already engaged 48,166 persons and yielded large quantities of iron and other ores, as well as lead, silver, copper and gold. In the year mentioned the amount of iron ore mined was 1,050,000 tons, weighing 60,700; sulphur pyrites, 27,848; copper ore, 13,895; manganese ore, 8,894; silver and lead ore, 3,707; pig iron, 732,734; bar iron, 526,353. Besides, there were produced 230 tons of gold ore,
3,707 tons of silver and lead ore, and 8,894 tons of manganese ore. About a third of the country is composed of gneiss, partially penetrated by granite. Patches of porphry and greenstone, of Silurian rocks, of olitite, and of cretaceous rocks, appear in various localities. Iron not only occurs in beds of immense thickness, but also is widely scattered. It is the principal mass of most of the country. The most celebrated iron-mines are those of Danelmora in Jämsas, where the iron worked is perhaps the best in the world, and is admirably adapted for steel. The quantity produced, however, is much smaller than in some other districts where the quality is also excellent.

Climate.—The climate of Sweden varies considerably with the latitude and elevation. There is hardly any spring or autumn intervening between the heat of summer and the cold of winter, but in the north the winter lasts for nine months, in the south only for seven. Speaking generally, the climate of Sweden, though much more like the proximity of the ocean, is not to be considered as anything like the interior of the northern parts of the Russian and Asiatic continents, is much more extreme than that of our own islands, even where the two countries are in the same latitude, and experiences greater degrees both of cold and heat. Hence at Stockholm the thermometer has been known to descend 26° below zero in January, and to rise in July to the almost tropical heat of 96.8°. The climate, however, is favorable to health, and no country furnishes more numerous instances of longevity.

Forestry and Flora.—Most of the public forests, covering an area of about 19,000,000 acres, belong to the government and yield considerable timber. In the very northern extremity of Sweden fine trees of pine, fir and birch are found. These, however, occupy only occasional patches, and the true forest-land must be considered as having its limit near 64°. Below this latitude, and chiefly in the central and southern parts of the kingdom, the forests occupy at least one-fourth of the whole surface, and sometimes stretch continuously for 80 miles in length by 20 miles in breadth. Many of these, however, consist of trees of stunted growth, chiefly for domestic fuel or the supply of the smelting furnaces, and seldom of much use as timber. Forests in which oak and beech are the prevailing trees occur only in the south. The flora is of the post-glacial period, and of Finnish characteristics rather than of more southern and continental latitudes. Wild briar berries are plentiful.

Fauna.—Among the larger wild animals the wolf and bear abound in the forests, and often cause great ravages. The elk and deer are also found, but in more limited numbers. Of smaller animals the most destructive is the lemming, which at intervals of years descends in immense numbers into the low country and lays it waste. Among birds the most remarkable are eagles, capercailles and woodcocks.

Fisheries.—The rivers and lakes are well stocked with salmon and trout, but the fisheries on the sea-coast have long ceased to be productive. Herrings, which used to visit the coast of the Baltic, have for the most part entirely disappeared, though large numbers of a fish resembling herrings are taken along the east coast. About 34,000 persons find employment in the fisheries.

Agriculture.—About 9.1 per cent. of the total area is under wheat, and 13.3 per cent. is under oats and 54.7 per cent. in forest, the latter furnishing a staple industry. Only a small portion of the arable land, and that mostly in the south, is favorable for the growth of wheat; but there is now a considerable export of oats and some of other cereals to Great Britain. Until recently the grain grown in Sweden did not suffice for domestic consumption. Potatoes are grown in almost all parts of the country, and form one of the main articles of food among the lower classes. The most important auxiliary crops are beet-root for sugar, hemp and flax, the latter of excellent quality; on a few favored spots tobacco, hops and madder are grown. Cherries, apples and pears are tolerably abundant in the southern districts. The principal domestic animals are cattle, sheep and reindeer. The last supply food and clothing. In 1917 there were 447,695 farms under cultivation, the products of which form a staple export.

Commerce, Manufactures, etc.—Of all the countries trading with Great Britain Sweden is the one with which the largest amount of business is done, Germany coming next. The total value of the exports to all countries in 1916 was nearly $206,991,000, of which 53 per cent. came from the United States, the exports to Great Britain amounting to half that amount. The total imports amounted to about $194,-811,000 (United States, 27.4 per cent.). The principal exports are timber, iron, butter and wood pulp; imports, iron and steel, wrought and unwrought, coal, machinery, woolen and cotton goods. Next to agriculture the most important industry in Sweden is iron-mining. Other industries now of some importance are iron-founding and engineering, the spinning and weaving of cotton and woolen goods, paper-making, brewing, sugar-refining, match-making and glass-making. In 1917 there were 9,368 miles of railways, of which 3,268 miles belonged to the state. The public telegraph and telephone lines in 1917, 341,013 miles, belong wholly to the state. A tram service operates between Trelleborg and Sassneth in Prussia.

The mercantile marine in 1917 engaged 2,801 vessels of 1,128,435 tons burden. The tonnage entered and cleared in 1913 was 28,799,114 tons. Trelleborg is the principal port and Stockholm comes next.

Weights and Measures.—The denominations of money are the öre and the krona, or crown (silver) 100 öre (each 1/32d.) = 1 krona = 1Kr. 1Nd. The greater part of the currency, however, is in paper, which is circulating in sums varying from 5 to 1,000 kronor. The metric system of weights and measures was introduced in 1883. Among old measures are the skulpund = 14.37 lbs. avoirdupois; the centner = 100 skulpund = 93.7 lbs. avoirdupois; the nylast (100 centner) = 83.67 cwt.; the kanna = 4.6 pints imperial; the cubic foot = 11.689 inches imperial; the tuneland or acre = 1 acre 35 poles; the mile = 6,644 United States miles; the square mile = 44 United States square miles; 10 linjer = 1 tun; 10 tun = 1 foot; 10 feet = 1 stöng (= 9.74 United States feet); 10 stönger = 1 ref., 860 ref., 1 mile.
The crown is hereditary in line. The king must be a member of the Royal Church, and has to swear fidelity to the land. His prerogatives consist of the right to preside in the high court of justice, to grant pardons and pardons to treaties with foreign powers, to declare war and peace, to appoint civil and military officials, and to veto absolutely any decree of the Parliament of the kingdom. He also has a power of appointment to his ministers and officials, and the grants of the blood-royal are excluded from civil appointments. The Diet consists of two chambers, which are both elected. The upper chamber consists of 150 members, elected by 25 provincial assemblies; and the lower chamber consists of 300 members, elected by the towns. Each member serves for six years. The second chamber, elected on universal male suffrage, consists of 230 members, elected for four years; and 80 for every 10,000 inhabitants. Members are paid 1,200 kronor for each session of four months, in addition to expenses incurred. The election is by ballot, and the president of the chamber, who is elected by the council of state, is chairman of the Diet. The executive power is in the hands of the king, who acts through a council of state consisting of members, chosen from among the heads of the different departments. The eight departments are: the Ministry of Justice, the Ministry of Foreign Affairs, the Ministry of Finance, the Ministry of Education, the Ministry of Ecclesiastical Affairs, the Ministry of Agriculture, the Ministry of War, and the Ministry of Marine. The Ministry of Finance is responsible for the conduct of the government. The control of the government is exercised by the Justices of the Peace, who are responsible for the conduct of the government. The total revenue of the state is estimated at 31,000,000 kronor, and the expenditure is 25,000,000 kronor. The total budget for the year 1916 is 5,000,000 kronor. Sinking funds are provided for the payment of the debt.

The army has hitherto been composed of enlisted troops, a militia maintained by land owners and Crown domains, and a regular army. The army consists of 10 regiments of infantry, 10 regiments of cavalry, 10 regiments of artillery, and 10 regiments of engineers. The total strength of the army in 1916 was 26,572 officers, 537 non-commissioned officers, 16,370 volunteers and a contingent of recruits. The total including conscripts was 85,000 men. The naval strength includes 15 armored coast defense vessels, 4 old torpedo gunboats, 10 torpedo-boat destroyers, 45 torpedo boats and submarines.

The ethnology of Sweden, with the exception of the Laplanders and Finns, found only in the north, are of Teutonic origin, and present the original features of the race in great purity, particularly in the central and southern provinces, where they are characterized by a tall, robust stature, light hair, blue eyes and light complexion. They are active and enterprising, and manifest a marked predilection for scientific pursuits. The state of morality is on the whole favorable. Heinous crimes are few, but a great number of minor delinquencies figure in the calendar and are evidently accounted for by the far too prevalent use of ardent spirits; but a considerable improvement in respect of the consumption of intoxicants seems to have taken place in recent times.

Religion and Education. Almost all the inhabitants belong to the Evangelical Lutheran Church, which is the religion of the state, at the head of which is the archbishop of Upsala. Other religions are tolerated; but appointments in the public service can be held by Lutherans only. Education is gratuitous and compulsory. Primary education is well diffused. In 1916 there were 704,000 pupils in the elementary schools. The proportion of illiterates among recruits is 0.16 per cent. The University of Upsala (2,344 students in 1916) has done much to foster the cultivation of the higher departments of science and scholarship. There is also a university at Lund (1,341 students in 1916).

Language and Literature. See Swedish Language and Literature.

History. In the case of Sweden, as of many other countries, the industry of chronicles has supplied details about ages with which they were acquainted. These early chronicles, called Sagas, contain lists of kings at variance with each other, and state that the adventure of the kind to which the epithet heroic is usually applied, in which it is impossible to separate the legendary from the historical. The first dynasty of Swedish kings, according to the legendary chronicles, belonged to a family called Ynglings, from their founder, Freyger Ingve, the reputed grandson of Odin, from whom the family claimed to be descended. The last of them was expelled by Ivar Widfadum, representative of the Danish family of the Skoldings, also descended from Odin, who united Sweden and Denmark under one rule. This event is referred to about 630 A.D. Near the end of the following century Ragnar Lodbrok, the reigning representative of this house, fell in battle on the English coast, and his second son, Bjorn Ironside, inherited Sweden, which was again separated from Denmark.

Christianity was introduced under his grandson, Bjorn II; but it was first established by Olaf, who reigned in the beginning of the 11th century (1001–26 A.D.). Until the beginning of the 12th century the chronicles contain rival lists of kings. From the first appearance of Sweden in history two rival tribes or confederacies, both of German origin, the Goths and
the Swedes, contended for ascendency, and the confusion of the chroniclers is probably due to the mingling of the lines of separate chiefs or monarchs returning simultaneously in different districts. Emund Sleme, the last of the descendants of Bjorn, was defeated and killed by the Goths in 1056, when the two nations were united under Stenkil, the Gothic monarch. On the death of Stenkil II, in 1129, the Swedes raised a private individual, Sverker I, to the throne. To conciliate the Goths it was agreed that Erik, a descendant of Stenkil in the female line, should succeed Sverker, and that the two families should reign alternately. This arrangement, which seems to indicate that the power of the monarchs was merely that of leading chiefs, was continued, though the cause of much dissension and civil war, for several reigns. During the reign of Sverker the kingdom was divided into four dioceses (1152). Erik IX, called Saint Erik, succeeded about 1155. In his reign the Finns were conquered and converted to Christianity. Charles VI, son of Sverker, who succeeded about 1162, canonized by Knut Erikson, who succeeded in 1168. Sverker II, the son of Charles, was likewise defeated and killed by Erik X, son of Knut, who succeeded him in 1210. John I, son of Sverker II, and the last of his line, was succeeded in 1253 by Erik XI, the last of his, who died in 1260. Waldemar I, nephew of Erik, was raised to the throne by election, and founded the dynasty of Folkungaar. Waldemar made a voyage to the Holy Land, leaving his brother Magnus in regency, in 1222; on his return a civil war took place, but Waldemar abdicated in favor of Magnus in 1279 and failed in subsequent attempts to recover the throne. Magnus assumed the title of king of the Swedes and the Goths. His son, Birger II, in whose reign the conquest of Finland was completed, was expelled by the people in 1319, who chose his nephew, Magnus Snake, an infant, as his successor. He had already succeeded, in right of his mother, to the crown of Norway, which he sought to his son Haco in 1349. Scania, consisting of the two southern provinces, Malmohus and Kristianstadt, which then belonged to Denmark, yielded to him in 1332, but he restored them on annulling his son Haco to Margaret of Denmark. Magnus was deposed by the states and obliged to carry on a civil war for the crown with his son Erik, whose death again left him in possession of the kingdom; but aiming at absolute power, he was again deposed in 1365 in favor of his nephew, Albert of Mecklenburg, who had already been in possession, since 1363, of the supreme authority. Albert formed a league with Schleswig, Holstein, Mecklenburg and the Hanse towns against Denmark and Norway. He succeeded in his driving the king of Denmark out of his dominions, but was defeated by the king of Norway, who besieged him in his own capital. Peace was concluded; but Albert, aiming, like his predecessor, at absolute power, made himself master of his own subjects, who invited Margaret of Denmark and Norway, the Semiramis of the North, who had united the crowns of these kingdoms, to replace him. Albert, though supported by Holstein, Mecklenburg and the Hanse towns, was finally overthrown and returned to Mecklenburg. Margaret succeeded in 1389, and by the union of Calmar the three kingdoms were formally retaining its own constitution. Under her grandnephew Erik (1412-44) revolted underly in different districts. His rule proved oppressive, the joint was renewed 1436, but both Danes and Norway were united under Erik, who was king of Denmark. His death in 1488 (Knutson) was chosen king of Norway also acknowledged him, but off the yoke. The severance of the produced a war with Denmark. The was stormy and his subjects repeat against him. He died in 1470. The king of Denmark, had been crowned in Sweden in 1458 by the party opposite, but on the death of Knuta chose his nephew, Sten Sture, adm the kingdom. Christian attempted to session of the kingdom, but was de forced to retire. In 1483 John I, son of Christian, was recognized as king of Sweden with the virtue of the titles of the kingdom, which was divided between the Danish national parties, but Sture contrived to administration, and raised an army to俄罗斯 out of Finland. In 1499 vaded Sweden with a powerful force, which was completely defeated at Rotebro, where John conferred on him the governorship of Dalecarlia; but the Swedes again proclaimed him administrador in 1501, in 1503 and in 1510, in 1521 the Senate, and the union of Scania with the Russians. In 1499 and formed an alliance with the Swedes in order to prosecute the war of Denmark. The clergy and a large part of the Senate favored the Danish alien peasantry were strongly opposed to Sture. He died in 1512 and was succeeded by his nephew, Sten Sture the Younger. In the year Christian II succeeded to the throne. After the death of Sture Vasa, the reign of the Dalecarlia, and, having established a Lutheran religion, was crowned Protestant archbishop of Upsala, in Lutheran religion was formally est Sweden in 1521. Christian II, driven from Denmark, his title was edged by his successor, Frederick I, was declared hereditary in his house in 1560. His son, Erik XIV, reigned years. Erik was one of the candidates for the throne of Sweden, and the power of the crown. Erik created a secondary nobility, reduced the titles of Count and Baron. A war with Russia, under the protection of the Teutonic order, the acquisition of Esthonia by Sweden having subsequently been confirmed, was, in the confusion caused by insanity, insurrection, and internal disasters to the Swedes. John III, of Erik, succeeded him on his death in 1570. Sweden renounced her claims and surrendered a large part of the west coast of the Baltic. A treaty was made with a view to a
Russia. In this war the Swedes were successful in foiling the designs of Ivan IV on Livonia. Peace was concluded in 1582. John had married Catherine Jagellon, daughter of Sigismund, king of Poland, and through her influence endeavored to restore the Catholic religion in Sweden. A formidable opposition arising, headed by his brother Charles, and the queen dying, he abandoned the project. Sigismund, his son, was, however, brought up in the Catholic faith, and in 1587 he was elected king of Poland under the title of Sigismund III; John died 1592. Charles, Duke of Sodermania, who held the regency in the absence of his nephew Sigismund, endeavored to deprive him of his crown on the ground of his religion, but on the return of Sigismund with an army he was compelied to relinquish the government to him. Sigismund, on receiving the crown, returned to Poland, and left his uncle Charles in the title of Gestaupkeus to seize the crown and defeated Sigismund in the battle of Sténbro (September 1598). The states now conferred on him the title of hereditary prince, and insisted upon Sigismund sending as surety to Sweden his son Gustavus Adolphus. He was acknowledged as king of Sweden, and in 1604 Charles was acknowledged as king of the Swedes, Goths and Vandals, and his son, Gustavus Adolphus, was recognized as his successor. He took the title of Charles IX. From these events arose a war with Poland, which was not terminated by a permanent peace till 1600. Wars also with Denmark and Germany continued till the end of Charles' reign. Charles IX died 1611, and was succeeded by his son, Gustavus Adolphus, then engaged in conducting the war with Denmark. One of the first acts of Gustavus was to select as his chancellor Alex Oxenstier, who became one of the first statesmen of Europe. Failing to make peace with Denmark, Gustavus took the field in person, and nearly lost his life in the battle of Widsji; but in 1613 he succeeded through the mediation of England in making peace. The Russian throne was then vacant, and Sweden putting up the candidates for it, Charles Philip, brother of Gustavus and Ladislaw, son of Sigismund. Both had invaded the country and made extensive conquests and Gustavus granted favorable terms to Denmark that he might turn his attention to this quarter. Michael Romanoff, elected in 1613, was compelled to make peace with Sweden by the cession of all his Baltic provinces; and Sweden, which notwithstanding internal troubles had been advancing in political importance since the time of Gustavus I, now became the leading power of the North. The war of succession with Poland still continued and in 1621 Gustavus turned his arms against that country and captured Riga. The war continued for nine years, and was concluded by the six years' truce of Altmark in 1629. Gustavus retained four frontier towns of East Prussia.

Sweden was now about to take for the first time a leading part in the affairs of Europe. Gustavus had been watching the progress of events in Germany, and had determined to interfere on behalf of the interests of religion and the political rights of the Protestant princes. (For the events of this war and the effects of the intervention of Sweden in the affairs of Europe see Gustavus; Prussia; Richelieu; Thirty Years' War, and other articles.) The body of Gustavus, who fell at the battle of Lützen, was brought back to Sweden in 1632, and his daughter Christina was recognized as his successor. She was a minor, and the management of affairs devolved upon the Chancellor, Gustavus Adolphus. He concluded an alliance with the German rulers, and made arrangements to prosecute the war with vigor. His power continued absolute till 1644, during which time the war in Germany continued. At the beginning of this year a war broke out with Denmark, provoked by the scheming of the queen-mother, who was jealous of the power of Oxenstiern. Denmark was suddenly invaded by Torstenson. Christina assumed the reins of government on 5 Dec. 1644, her 18th birthday, and peace prevailed, and the treaty of Brömsebro was concluded with Denmark, which ceded to Sweden the greater part of her possessions in Götland, and exempted Swedish vessels from the sound and the lübeck. Leibnitz, 24 Oct. 1648, gave Sweden western Pomerania, the duchy of Bremen and other acquisitions in Germany, with a seat and triple vote in the diet.

The reign of Christina began under favorable auspices. She had received a masculine education, and showed great attention to business and determination in supporting her views. Contrary to the advice of Oxenstien she exerted herself to promote peace both with Denmark and Germany. She patronized learning, and drew many distinguished men to her court; but she was extravagant in her expenditure, licentious in her behavior, and soon brought herself into inextricable difficulties by the profusion with which she lavished the crown domains on worthless favorites. In these circumstances she renounced the crown in 1654 in favor of her cousin Charles Gustavus, son of the count palatine, professed the Catholic religion, and after an extraordinary career died before Rome in 1660. Each set the candidates for it, Charles Philip, brother of Gustavus and Ladislaw, son of Sigismund. Both had invaded the country and made extensive conquests and Gustavus granted favorable terms to Denmark that he might turn his attention to this quarter. Michael Romanoff, elected in 1613, was compelled to make peace with Sweden by the cession of all his Baltic provinces; and Sweden, which notwithstanding internal troubles had been advancing in political importance since the time of Gustavus I, now became the leading power of the North. The war of succession with Poland still continued and in 1621 Gustavus turned his arms against that country and captured Riga. The war continued for nine years, and was concluded by the six years' truce of Altmark in 1629. Gustavus retained four frontier towns of East Prussia.
any German power during her war with Holland. In consequence of this treaty the Swedes invaded Brandenburg in 1674. They were defeated by the elector at Fehralin, 28 June 1676. After this victory Denmark entered into a league with the elector against Sweden. In the hotly contested war which ensued Sweden was defeated by the elector on land and by the Danes at sea, but her ally was victorious. Louis XIV compelled the elector by the treaty of Saint Germain-en-Laye to restore to Sweden all her German possessions except a district beyond the Oder, and by the treaty of Fontainebleau Christian V engaged to restore all his conquests to Sweden. Peace was concluded on these terms between Sweden and Denmark at London, 26 Sept. 1679.

Sweden, whose financial resources were always limited, had, however, been impoverished by the war, and the nobility, who during the minority of Charles had acquired the chief power in the state, although the king had assumed the government in 1672, became unpopular. A revolution was accomplished in 1690, in which the states, under the guardianship of a military force, declared Charles absolute and irresponsible, and entitled to dispose of the government as his last will. The remaining years of Charles XI were employed in organizing the army and restoring the finances. He adopted a regular system of conscription, which greatly strengthened the military power of the nation. He died 15 April 1697. His son, Charles XII, born in 1682, was declared of age in November. His youth induced Denmark, Poland and Russia to enter into a league against him to partition his dominions. Embarking for Copenhagen in 1700, he soon disinherited the plans of the allies, and refusing peace began a career of conquest, which after many marvellous successes ended in the disastrous battle of Pultava, 7 July 1709. After an exile in Turkey he returned to Sweden in 1714, reconciled himself with Peter the Great, and was pushing the conquest of Norway when he was killed at the siege of Fredrikshall, 30 Nov. 1718. The Swedish states passing over Charles Frederick, son of Charles' elder sister, named the second sister of Charles, Ulrica Eleonora, queen, who in 1720 associated with her husband Frederick I. The revolution was accomplished so suddenly that it led to a suspicion that Charles' death had been anticipated, and it has always been suspected that he fell by the hand of an assassin. The new government allied itself with Great Britain, and ceded the duchies of Bremen and Verden, the cause of quarrel between Charles and England, to George I. Peace was concluded with Poland on the basis of the treaty of Oliva, and with Prussia, to which Sweden ceded the territory between the Oder and the Memel, Stettin, the islands of Wolin, Bornholm, and Sweden. By the Treaty of Stockholm, 12 June 1720, Sweden paid Denmark 660,000 rix-dollars, and renounced the freedom of the Sound, while Denmark restored Kneen and other conquests in Pomerania and elsewhere. War still continued between Sweden and Russia. It was terminated by the Treaty of Nystad, 10 Sept. 1721. Sweden received 2,200,000 t. r. Livonia, but she finally lost the valuable Baltic provinces for which she had so long contended. Of her corsaria only restored Finland.

Sweden was now under the hands of garcy. This council was easily bribed by the German powers. It was called (after 1738) the Hats and Caps of which preferred to sell their France, the latter to Russia. On the out of the war of the Austrian Succession, Sweden, who had been irritated by the indignation of the Russian Empire of their ambassador to the Porte, was induced by France to declare war with the war on the part of Sweden, from incapacity and the selfishness of her ally was ill conducted. On the accession of the peace was concluded by the Abo, 17-18 Aug. 1743, by which Swumann forever her claim to the ceded by the Treaty of Nystadt, the part of which was the main ceded part of Finland, the boundary the two states being fixed at the river by the influence of Russia Adolphus of Holstein was elected successor to the crown, to which he succeeded on the death of Frederick I in 1731. During his reign Sweden took some part in the Seven Years War. At home the country was distracted by quarrels of the Hats and Caps, and power sank to a shadow. Adolphus 1771 and was succeeded by his son III. His reign was distinguished by chivalric revolution. He undertook a war against Russia, which brought him fame in the battle of Parnawa, was productive of no other result, and was assassinated in 1792. In 1809 Gustav IV was deposed, and his family future incapable of succeeding to the throne (The leading events of his reign will under Gustav IV). His uncle, the Sudermania, was declared king with the title of Charles XIII. He concluded a war with Russia, begun by Gustavus, by the Treaty of Tilsit, 17 Sept. 1809, by which Sweden rendered Finland, the Åland Islands at West Bothnia to Russia. In 1810 elected Jean Baptiste Bernadotte, crouned in the In the final struggle with Napoleon p 1814 Sweden joined the Allies, while the part of France. The Dano-Those driven out of Holstein by Bernadotte Treaty of Kiel was concluded between Denmark and Great Britain, 14 Jan. 1814 by this treaty ceded to Denmark German possessions in Pomerania, at of Rügen, while Denmark was ceded Norway to Sweden as a compensation for the loss of Finland. This was by the Norwegian Storting on 4th of 

Greenland, the Faroe Islands and which had belonged to Norway, were by Denmark. Sweden now held the whole of the Scandinavian Peninsula, and had in other European possessions. Bernadotte succeeded to the crown in 1818, under the name of Charles XIV. Under his reign Sweden advanced greatly in agricultural and prosperity. He died in 1844, and was by his son Charles, Louis Eugène, under t
V. Charles XV died 18 Sept. 1872, succeeded by his brother, Oscar II, on 8 Dec. 1907, was succeeded by the present king Gustav V. On 7 June 1940 to the refusal of Sweden to grant consulates to Norway, the Storting passed a resolution to dissolve the Reich was finally ratified by the Treaty ad by both countries on 16 October, over Prince Charles of Denmark the King of Norway.

9 Sweden experienced one of the most industrial strikes in the history of states. Beginning in a few industries, soon involved nearly 300,000 men for two months, completely paralyzed, commerce and transportation failed, and the defeat of the strikers.

in the World War.—The World which stimulated agricultural production in branches of mining, entailed great on the majority of the people, and development in the country became frequent, especially the urban districts. Up to the later the war the attitude of the Court (the was formerly Princess Victoria) of the military and official classes general of benevolent neutrality toward all Powers, while that of the Socialists, neutral, was more favorable to the The strict enforcement of the British by the seizure of contraband be sent through Sweden to German, detention of mails from the United aused intense irritation; and on the nd, the German submarine campaigns, sinking of Swedish ships, raised con feeling against Germany. Sweden's as a neutral was seriously comprom the revelations made by the United government in September 1917 that the Foreign Office was permitting German messages from foreign countries to be its own messages, these including mes om Count Luxemburg, German Chargés at Buenos Aires, in reference to the of ships of the Argentine Republic by es, the most extraordinary of which his government that Argentine vessels not be sunk at all, or sunk without any trace (spurios versendt). These as raised a storm of indignant protest allied countries, and a breach of dipollations between Germany and the Ar was narrowly avoided. Two changes nent were made in Sweden in 1917, one of the second of which, under the hip of Mr. Eden, ensured a national more acceptable to the Entente nations. ample to hold an International Peace post promoted by Socialist groups in and neutral countries, was prevented of the French, British and Italian ents to issue passports.

ography.—Guinchard, J., 'Sweden: Historical and Statistical Handbook' (London 1914); and British Foreign Reports: Bald, 'Norway, Sweden and o' (London 1912); Bain, 'Scandinavia: al History of Denmark, Norway and (Cambridge 1905); Barnes, 'Things Sweden' (London 1915); Drachmann Søergaard, "Independent Development and Commercial Policy of the Three Scandinavian Countries" (ib. 1915); Kennedy, E. B., 'Thirty Seasons in Scandinavia' (ib. 1903); Leach, H. G., 'Scandinavia of the Scandinavians' (ib. 1918); Steffansson, J., 'Denmark and Sweden' ('Story of the Nations' ib. 1916).

SWEDENBORG. See SWEDBERG.

SWEDENBORGANS. See CHURCH OF THE NEW JERUSALEM.

SWEDISH LANGUAGE.—The North Germanic dialects seem to have differed very little from each other originally. A fairly uniform language was spoken all over the North which in English and Scandinavian sources is often referred to as "Donsk tunga." During the Viking age, between 700 and 1100, four dialects developed from the original Old Norse: Icelandic, Norwegian, Danish and Swedish. The former two are grouped together as Westnorse, the latter two as Eastnorse. Among the distinguishing features may be mentioned the passive ending -s for Eastnorse, where Norwegenian and Icelandic have -sk, f. i. kallas "to the called" versus kallas "to be called." The Old Swedish period extends to the time of the Reformation and covers geographically only not only Sweden proper, but also the coast districts of Finland and Livonia. Our knowledge of the earlier stage of Old Swedish is based on Runic inscriptions which only in the 13th century were replaced by the Latin alphabet. During the later Middle Ages many phonetic changes took place which tended to differentiate Swedish more and more from the other Scandinavian branches, such as lengthening of vowels, the Genitive ending -s instead of -r, the relative pronoun sum in place of aer, etc. The vocabulary absorbed many foreign elements, especially from Danish and German, as f. i. numerous industrial and commercial terms, all the verbs in -era (= German -ieren), the suffix -het (= -heit), the prefixes be-, bi-, un-. From this somewhat chaotic stage of transition which is characterized by absolute lack of linguistic norms or standards, modern Swedish emerges gradually as a literary language. The first complete Bible translation which is named after Gustavus I and appeared in 1541 is regarded as the first monument of modern Swedish literature. Throughout the 17th century grammarians and purists made efforts to create national standards and to eliminate foreign elements. In spite of that, however, a large number of French words crept into Swedish, especially in the 18th century and have maintained themselves to this day. The internal linguistic changes concern chiefly the simplification of case endings or inflections and the adoption of certain sound-shifts which are characteristic of modern Swedish, such as the s-sh sound for combinations like sj, stj, skj. The pronoun of address became ni instead of I. Since the middle of the 18th century Swedish grammar has changed very little, while the vocabulary shows quite a different appearance, particularly since the enormous wealth and variety of expression which is stored up in the dialects has been utilized by modern writers. The dialects of Dalarna and the island Gottland are especially noteworthy on account of their quaintness and archaic character.

Accent.—Longfellow who first introduced
SWEDISH LITERATURE

Swedish writers to the American public, characterizes the Swedish language as soft and musical with an accent like the Lowland Scotch. Jacob Grimm considered it even the most musical of all Germanic languages, comparable to Italian among the Romance languages. This musical character of Swedish is partly explained from the fact that it has retained full endings like -a and -o in many positions where the other Germanic languages have such sounds ended them entirely. More important, however, are the peculiar laws of pitch and modulation which hardly any other language has developed with such consistency. Certain combinations of stress and tone result in definite forms of a musical cadence of "tonlåg." The simple tonlåg, or acute accent, differs very little from that employed in other languages, the compound tonlåg occurs only in Norwegian and Swedish: the voice first sinks about two tones and rises suddenly two or three tones on the second syllable with a weak secondary stress. The question of accent and modulation is one of the chief difficulties in the study of Swedish.


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SWEDISH LITERATURE. The intellectual life of the North has been at all times more or less dependent on central Europe, especially on German and French civilization. Swedish literature shows these influences in a marked degree and has only within the last generation produced writers of distinct originality and more than national significance. The mediæval period appears rather meagre as compared with those of Norway and Ireland, Codes of laws, chronicles, legends of saints, adaptations of chivalrous romances and didactic writings: these or similar categories cover a literary activity which is altogether imitative and chivalric of philological appearance. Among the historical documents may be mentioned the Erics-chronicle, covering the period from 1230-1320, the Nyh Chronicle (1400) and the so-called Small Kvhmechronique which contains some interesting autobiographies of Swedish kings. The most conspicuous religious character of the later Middle Ages was Saint Birgitta, who, after an extended experience as wife and mother, turned her mind to things spiritual, undertook reforms of all kinds, founded a religious order, came in touch with the leaders of heretical mysticism and was finally canonized in 1373 in Rome. She contributed to Swedish literature a volume of visions or "revelations" which in spite of their absurdness exhibit a remarkable power of imagination. Her personal influence and the activity of the Birgitta order which was centred in Vadstena, can be traced through the whole intellectual life of the North, especially in the direction of building up a national church and encouraging the use of the mother tongue. The ballad literature of the 14th and 15th centuries is not so extensive as that of Denmark or Germany, but corresponds otherwise in subject and form. Many of these lays and ballads wandered evidently from one country to the other and exist in numerous versions. More than 60 have been counted of the famous ballad "Elveskud" (translated by Herder as 'Erikings Daughters') which describes the dangerous lure of dancing elves. The Swedish ballads have been collected by Geijer and Aftelius as *Svenska folksvisor* (new edition by Bengtsson). Swedish thought and literature received a powerful stimulus from the gradual adoption of the Lutheran faith in the course of the 16th century. This movement is closely associated with the names of the brothers Petri, Olavvs and Laurentius, and of Laurentius Andreas. All three of them contributed to the translation of the Bible which appeared complete in Upsala in the year 1541 and which for the history of the literary language in Sweden may claim a similar position as Luther's translation for German. Apart from a rich controversial literature called forth by the religious movement, we meet with attempts in the dramatic field, such as treatment of biblical stories, allegories and school comedies. The most versatile writer of this period is Johan Messenius who, among other things, planned a systematic dramatization of subjects taken from Swedish history but who only completed six of such plays.

The heroic century of Modern Sweden, the age of Gustavus Adolphus and Charles XII, proved to be relatively unproductive in the field of literature. The dominant influence of Renaissance poetries throughout the 17th century discouraged spontaneous expansion and established in most European countries classicistic standards and a rule of formalism. Sweden reverses her "father of literature* in Georg Stjernhjelm (1598-1672), a stern disciplinarian who aimed at purity of language and formal interpretation. He wrote a number of epic and didactic poems of an allegorical character, among them his famous *Hercules at the Cross-road* and distinguished himself besides as a scholar and scientist in many fields. He introduced a number of classic and romantic metres into Swedish poetry and gained remarkable skill. His contemporary Gunnar Dahlstjerna employed even the Ottave rime (with six iambic feet) in his patriotic poem *Kunca-kald,* and is still appreciated as the author of *Gudina Kampevisa* in which Charles XII and Peter the Tzar are the leading
The greatest metrical genius of his
day was Johan Runius (d. 1713), while the
Jacob Frese shows more natural
talent. Samuel Columbus and Jesper
Lindbeck (1630-1702) still arouses our
attention as an author of the treatise 'Atlantika'
he tried to prove that Plato's Atlantis
did exist in Sweden and that here or
elsewhere he has found the
Rudbeck taught at Upsala which
reign of Queen Christine had be-
great centre of learning and attracted
many scholars from all parts of Europe,
like Descartes, Hugo Grotius and
literary sceptre of Stjernhjelm as
in the republic of letters passed later
bands of Olof von Dalin (1708-63)
his literary style and ambitions might
ared with the English rationalist Pope
and his career by editing a periodical
edish Argus which was modeled after
S Spectator, and developed later into
lent prose writer and brilliant satirist.
2. Om Hästen' ('Tale of the horse') is
ostentatious display of satirical
allégorie. While Dalin leaned at first
sh models, the literary taste of the age
d the whole to be French, first in
ner of Voltaire as in the case of the
Creutz and Gylenberg, or of Kell-
Leopold, later in the manner of
whose theories were introduced into
by Thomas Thordil. Among the
productions of this school deserve
mentioning Creutz 'Atis and Camilla,'ing idyl in the style of Gessner, Kell-
Nya Skapen' (the new creation),
llenberg's novel 'Min Son på Galejen'
on the galley), a great favorite to this
account of its splendid hum. King
III (1771-92), nephew of Frederick
and one of the most gifted rulers of
it did not only further the arts
and in the most generous way, but wrote
patiotic plays of considerable merit.
Gustavus' immediate friends who
atmosphe the spirit of romanticism,
xenstjerna, Bengt Lidner, the poet of
It and passion, G. Adlerbeth, author of
illråda,' the most famous Swedish
of this age. The revolutionary pathos
mas Thordil inaugurates the new
alism in Sweden which worshipped at
e of Rousseau, Klostock and Ossian.
entering upon this new phase a word
be said about the most unique lyric
this century, who is still dear to the
of his countrymen: Karl M. Bellman
He belongs with Robert Burns, or
ch vagabond Villon to the class of
bohemians who seem to be entirely
in the shackles of school or convention,
ical to us more like voices of nature
dated literary form. The most
Bellman's best-known poems, among
osity dramatic sketches of tavern life,
tained in the collection: Vreden's
They seem more like free improvisa-
finished works of art, but it is this
ful freshness and bold impressionistic
manner which fascinates the modern reader as
much as their original audience.
The transition from the older 18th century
formalism to the Romantic age in Sweden
presents quite a dramatic spectacle. The first
writers who showed a more adventurous spirit
were Fanzen and Wallin, the latter still known
as the editor of the Swedish psalm-book and
as the author of a glowing ode addressed to
George Washington. After the revolution of
1809 the Swedish Academy ceased to be arbiter
of public taste, and soon the leading writers
of the Romantic movement in Germany were
eagerly studied and imitated. Two parties
formed and carried on a lively feud for a num-
ber of years: the Phosphorists, so called after
their periodical 'Phosphorus,' were more inter-
interested in the speculative elements of
German mysticism, as represented by Schelling or
Novalis, the Gothicists wished to strengthen
national ideals and to revive the old sagas
and ballads of the romantic Middle Ages.
The head of the first group was Peter Atterbom
(died in 1855), whose phosphorescent visions
recall somewhat the ethereal, transcendent
style of Shelley or Keats. Other members
were Nyberg, Dahlgren and Stagnellius, a
mystic and seer, reminding
us of the leading minds of the Gothicists were
Erik Geijer, equally great as poet and historian,
Per Ling who tried to revive the old saga style,
and his much greater follower Esaiah Tegner,
author of the Frithjofs Saga, Sweden's national
epic. Somewhat independent of either school
remained Karl Nicander who selected chiefly
Italian subjects and themes for his poetry, Chr.
Fahlcrantz, still quoted as a humorist, and
Johan L. Almqvit (1793-1866), an erratic
genius who combined exquisite delicacy of senti-
ment (as in his collection of lyrics: Törnrosens
hök) with an extravagant, even lawless
imagination and quite heterodox views on love
and marriage.
The chief by-product of the Romantic move-
ment, the historical novel, flourished in Sweden
perhaps even better than in England or
Germany. Gumalius, Crusenstolpe, Ridderstad,
Sparre and many others have contributed to
this genre. The Finlander Topelius so called
'Surgeon's Stories' which contain many
centuries of Swedish history, were widely read
in this country at one time, but slumber now
peacefully on the shelves of our libraries side
by side with Rydberg's famous novel 'The
Last Athenian,' and with Frederika Bremer's
once so popular stories and sketches of
Swedish home life. The last-named writer ap-
ppears already quite emancipated from Romantic
doctrines and points toward the coming age of
Realism. Swedish literature, as may have been
noticed, is immensely strong in the field of lyric
poetry, whereas the realistic novel of the
Dickens or Eliot type is rather poorly repre-
sented. Fr. Cederborgh, Karl Wetterberg,
August Blanche, Sofie von Knorring and a few
others present various aspects of Swedish life
and society in their novels. The realistic note
which had already been heard in the poems of
Anna Lenngren (died 1817), becomes more
and more prominent, and is reinforced by
humor and satire in the songs of W. von Braun,
Wennerberg, Sturzenbecker, and the witty
improvisations of Johan Wadsen. But all these
minor talents disappear by the side of the greatest poetic realist of his age: Johan L. Runeberg, the pride of Finland. His chief work is a collection of patriotic poems and ballads: 'The Finnish National Heroine,' which were inspired by the second Finnish War in 1809, and are rightly considered the most beautiful tribute that has ever been paid, to the patriotic enthusiasm of a small nation. The idyls 'Elk-hunters' and 'Hans' are the influence of Goethe's epic style and, with a large number of exquisite lyrics, give evidence of Runeberg's remarkable power to invest the simplest and most primitive aspects of life with genuine pathos and poetic dignity. He deserves to be classed in this respect with poets of the rank of Goethe or Wordsworth. Runeberg taught for many years in Borås, Finland, and died in 1877.

Two years after Runeberg's death, in 1879, there appeared a novel in Sweden under the title 'The Red Room' by August Strindberg, which inaugurated a new type of Realism and a new literary era. A few years later Geijerstam attempted in his first novel 'Erik Grane' to epitomize the great intellectual and social revolution which had gradually spread from one country to the other and was inspired by three constructive ideals: a political and social democracy, a reconciliation of science and religion, and a new aesthetic creed which substituted the truth for beauty. The compelling figure in this movement is August Strindberg, epomatching in all fields of literature and at all times a seeker of truth. Most of his writings are now accessible in English translations. Gustav af Geijerstam (1858–1909) who as a novelist has gained great popularity both in Sweden and Germany, is practically unknown to the American reader. This may be explained from the distinctly national or even provincial character of his art, partly from the peculiar inwardsness and savagery of his analysis which avoids striking plots or situations and instead delves down into the deeper strata and hidden recesses of soul life. However, such stories as 'Astray in Life,' 'Pastor Hallin,' or some of his short stories, are not only the theme of his later novels, like Erik Forsslund in 'Stockholm,' but are appealing more than some of Strindberg's rather morbid productions. Among the younger followers of the new realism may be mentioned Albert Engström, editor of the periodical 'Strix' and known through his descriptions of peasant life, sailors and fishermen. Two Swedish American novels may be added, one by Hilma Angered-Strandberg, called 'The New World' describing the struggle and failure of two people who have come to this country, the other by Henning Bergner, 'Isai' which contains a splendid description of Chicago as the great melting pot of races. The influence of Maupassant and Flaubert is noticeable in Hjalmar Söderberg's clever sketches of Stockholm society ('Historietten' and 'Blunders'), as well as in his novel 'Martin Birks Youth,' a story of disillusioned youth. Sigrid Siwertz, a short story writer, seems to develop in a similar direction, as, for instance, in his collection 'The New Robinson' (1887). In 1890 the pendulum seems to have swung back in the opposite direction of an idealistic or neoromantic interpretation of life.

Such is the literary creed of Selma L. the leading writer of the day, whose tales from Gösta Berling to the 'Poet of Portugallia' are being read in many. Her art certainly is the classic Waller definition of the romantic as 'strange to beauty.' Far less known is.

Heidenstam, author of the 'Karmac' series of tales grouped around the hero of Charles XII. This book has become a classic. Oscar Leverton died in 1883 may be regarded as the leading critic.
found in Vol. III and XVII of his de Skriften;" Runeberg is treated by in his "Northern Studies," London 1879.
and was severely wounded in the siege of Shiloh (1862 et seq.) and the årskatalog för bokhandeln.

Ewald A. Boucke,

EDISH MOVEMENT-CURE, a system of treatments devised by Peter Henrik
1776–1839), a Swedish poet, and fostered
dveloped by the Swedish government. It is of remedial or localized movements of to restore the normal movement of the tissue of cells when it has become disarranged.
This method, as variously modified by velopment of modern mechanotherapy, is associated with massage. The muscular

Keny, Thomas William, Irish-American

1, Astoria, L. I., 10 April 1892. He came
United States in 1832 and settled in New
where, after finishing his education, he preinticed to the printing business. He identified himself with the military com-

SWEENEY, William Montgomery, son of the foregoing: b. New York, 29 Aug. 1871. He was educated at public and private schools and academies in New York and Augusta, Ga. He has written for the press and contributed biographical articles to "Officers of the Army (Regular) who served in the Civil War" (Philadelphia 1892); "History of the Twelfth Regiment, N. G. N. Y." (New York 1894); "Journal of the American-Irish Historical Society" (Boston 1899); "White's National Cyclopædia of American Biography" (New York 1901) and Lamb's "Biographical Directory of the United States" (Boston). He is the author of the "Life and Services of Thomas William Sweeny, Brigadier-General, United States Army" (New York 1907) and editor of "Sweeney's Narrative of Army Service" (1846–53); "Captain Thomas Cook, a Soldier of the Revolution (1752–1841)" (New York 1909) and "Some Notices, Genealogical and Historical, of the Cook, Dandridge, Higgins, and Reagan, Reo and Sweeney Families" (in manuscript).

SWEET, Benjamin Jeffrey, American

military officer: b. Kirkland, N. Y. 24 April
SWEET — SWEET-GUM

1832; d. Washington, D. C., 1 Jan. 1874. In the Civil War he was colonel of the 21st Wisconsin. In 1863 he was placed in command of Camp Douglas, Chicago, where 10,000 Confederates were imprisoned and successfully circumvented the efforts of Confederate societies to seize Chicago and liberate their friends. He was made brigadier-general of volunteers in 1865 and in 1872 was appointed first deputy commissioner of internal revenue.

SWEET, Henry, English philologist: b. London, 1845; d. 30 April 1912. He was educated at King’s College, London, at Heidelberg University and at Balliol College, Oxford. He devoted himself to the study of phonetics and Old English philology and became one of the foremost authorities on both subjects. His researches into Chinese and Arabic were also of high value. From 1901 until his death he was University reader in phonetics at Oxford University. He edited numerous Old and Middle English works and was author of many papers on phonology and of 'A History of English Sounds' (2d ed., 1888); 'Primer of Phonetics' (1890; 3d ed., 1906); 'The History of English Phonetics' (1903).

SWEET, John Edson, American engineer: b. Pompey, N. Y., 21 Oct. 1832; d. 8 May 1916. He was educated in the district schools, became a carpenter’s apprentice and rose to be a builder and architect in 1850. He was employed in his profession in the South until 1861; engaged as an inventor and mechanical draftsman until 1873; from 1873-79 was professor of practical mechanics at Cornell. From 1888 he was president of the Straight Line Engine Company. He founded the American Society of Mechanical Engineers, of which he was president in 1883-84, and an honorary member. On his 80th birthday in 1912, he was given a banquet by the society. He was government expert and juror on machine tools at the World’s Columbian Exposition in 1893 and in 1899-1901 was first president of the Engine Builder’s Association of the United States. In 1904 he was given the John Fritz Medal, which is awarded by a board of 16 of the leading mechanical engineers of the United States and Electric Engineering Societies. In 1914 Syracuse University conferred upon him the degree of Doctor of Engineering.

SWEET-BAY, the classic laurel (Laurus nobilis), or bay-tree of the Mediterranean regions, which becomes a tree of some 50 feet in its native habitat, but is cultivated as a shrub farther north, being often trimmed like box. (See BAY.) It has handsome, lanceolate evergreen leaves, dark-green and shining, which have an aromatic odor and taste and are, therefore, employed in cookery and for pickling fish. They have also some therapeutic value and yield a thick oil which is incorporated into ointments and liniments. The sweet-bay of America is the small tree (Magnolia virginiana) called more frequently swamp-magnolia or swamp-laurel. See Magnolia.

SWEET-BRIER. See Eglantine.

SWEET-FERN, a low shrub (Comptonia peregrina), with many brown branches and long linear leaves, so deeply pinnatifid on either side of the midrib as to appear fern-like. The flowers are dioecious, without perianths, and appear when the leaves are fertile in globose amethysts follow-in 1 foot—rny nuts invested shaped persistent bracts. The fruits are longer and clustered at the ends of the peduncles. Young foliage is pubescent, and the plant has a strong aromatic fragrance bruised or under hot sunshine. It was included in the genus with the spicig—apple and is often found growing with it. Soils or on hillsides further inland. Leaves are sometimes used as a substitute for tobacco.

SWEET-FLAG. See Flag, SWEET.

SWEET GALE. See CANDLES.

SWEET-GRASS, a name given to plants, most of which are fragrant, especially drying. The small Anthoxanthum odorum of the sweet vernal grass and has narrow-like panicles of spreading one-flower clusters. The leaves are flat. This plant is introduced from Europe and is found in meadows over nearly the whole of the United States. It was given to the fragrance of the grass Stipa triciojorada is the vanilla-grass of Europe, which is strewed about churches and religious processions. Material from which the Indians of the Lawrence region weave their thin mats that, when made of the grass, retain their odor of new mown hay in Panicula is a genus of grasses for grass because cattle are said to be icious. Another sweet-grass (Apera rata) does not in the least resemble grazing whorls of leaves and white flowers in cymes. When dried it is however.

SWEET-GUM, a large American (Liquidambar styraciflua), reaching its size in the South Atlantic States, where it grows tall, strong and beautiful. It attains to 80 feet above the ground. The head is pyramidal when young, but when old grown the heads are likely to become rounded. The five-lobed, star-shaped perianth is form thick, dark brown, and is to the brilliant hues in autumn, the young especially being gorgeous in large star-like leaves, bright-green beneath. Tiliaceous flowers are inconspicuous and perennial. They are gathered into clusters of the pistillate ones being succeeded by globose and spiky with the points beaked woody capsules, which are twisted and allow the scanty fertile escape through gaping orifices. They are long stalks far into the winter. To very rough, and in young branches is peculiarly winged by numerous ridges of undulating outline, which suggested the name of alligator-wood. It is smooth and satiny and would beeast as a substitute for black walnut, were liable to warp and difficult to season. With a rinosus sap, which is used in a liquid like that of Liquidambar orientals in Asia, might be a source of gum stor migratory sap to seasonal parts under the the same name. The sweet otherwise known as star-leaved gum, or bilateral, red gum or opal.
SWEET MARJORAM. See MARJORAM.

SWEET PEA, an annual herb (Lathyrus odoratus) of the family Fabaceae. It is supposed
natively of Ceylon, Sicily and Sardinia, the original pink-and-white and the red varieties
being credited to the first country and the pure white and purple varieties to the other two
islands. The known history of the plant begins in 1650, and the first record of its cultivation in
1699, when Father Francisca Cupani grew it
at Panormus, Sicily. By 1730 the seed was com-
mercially known, and about 60 years later five
varieties were offered by a London seedsman.
Until Henry Eckford commenced experimenting in
1876 for the production of new varieties there
were, however, rarely 12 varieties offered in
any one year. Largely due to his efforts the
list of varieties had risen to 150 in 1885, and
the popularity of the flower had vastly extended.
It has been estimated that since 1900 the aver-
age annual crop of sweet-pea seed is about
100,000 pounds, about one-fifth of which is pro-
tected by patents. The nearly all the seed used in Europe and America is now grown.

The sweet pea is a hardy annual herbaceous
vine with rough, winged stems, tendril-bearing leaves composed of two lateral leaflets borne on long
stalks, and fragrant papilionaceous flowers of
various shades, ranging from white to blue and
red through many tints, and including both double and *hooded* forms. The pods are
about two inches long, and contain about six
known seeds. The double varieties are regarded with favor, being rather unkempt and
lacking theaintiness of the single sorts.

For best results in the garden, sweet peas
should be planted very early in the spring or
even during the previous late autumn. They
will thus obtain an early start, and their roots
will penetrate more deeply into the cool, moist
soil before warm weather arrives, than if sown
later. Moderately rich soil of a rather heavy
nature generally gives the best results; very rich
soil tends to grow vine and leaf at the expense
of flower; very poor ground is prone to produce
small short-lived vines and little flowers which,
however, are often pronouncedly fragrant. The
seeds should be scattered thinly in trenches
about five inches deep and four or more inches
broad. The distance between rows should be
about three and one-half feet, the seed covered
about one inch deep, and as the plants grow the
earth should be drawn toward the vines until it
forms a ridge two or three inches high. When
the plants are well above the surface they
should be provided with supports upon which to
climb. Brush and poultry netting are generally
employed. Throughout the season clean,
shallow cultivation should be given and the
flowers gathered daily. This last will consider-
ably extend the season since the formation of
seed tends to a cessation of growth.

Several closely related species are cultivated
for ornamental purposes but are less popular
than the sweet pea. The following are
notably the following: The Tangier scarlet pea (Lathy-
rus tangistanus), an annual herb which blossoms
earlier than the sweet pea and should be planted
separately because of its greater strength and its
tendency to crowd out the other varieties. The
perennial or everlasting pea (L. latifolius), an
dolorless species with many-flowered clusters of
diversely colored blossoms. It is popular for
planting among rocks, in rough places and for
screens, for which its rampant growth and hardi-
ness recommend it. L. rotundifolius and L.
grandiflorus are also called everlasting peas and
are cultivated to some extent, as are also L. mari-
timus, the sea or seaside pea, and L. palustris,
the marsh or wing-stemmed pea—the latter
grown in damp places.

Consult Hutchin,'All About Sweet Peas'
(1894), and 'Sweet Peas Up to Date' (Philadel-
phia 1897); Bulletins 111 and 127, Cornell
Agricultural Experiment Station (Ithaca 1895,
1896); Bailey, 'Standard Cyclopedia of Horti-
culture' (New York 1916).

SWEET PEPPERBUSH. See CLETHRA.

SWEET POTATO, a tuberous-rooted perennial herbaceous vine (Ipomea batatas)
of the family Convolvulaceae. The plant is of un-
known origin but is supposed to be a native of
tropical America. It has roundish or angular
heart-shaped leaves, and in cultivation rarely
produces blossoms, where the flowers resemble
those of morning-glory, but are smaller. The
tubers, which are borne below the crown of
the plant, are without well-defined eyes. The
plant was cultivated by the natives before the
landing of Columbus. It is now extensively
grown in many warm and mild climates, es-
pecially in the Southern States, California and
the Atlantic Coast as far north as New Jersey.
The annual crop aggregates about 50,000,000
bushels, and the yield per acre varies usually
between 200 and 400 bushels, though with best
management and favorable season 800 bushels
or even more are occasionally obtained.

The sweet potato is propagated less by its
tubers planted in the field than by sprouts ob-
tained from the tubers in hothods, etc. These
sprouts or 'draws' are transplanted in the field
as soon as the weather has become settled and
after the land has been deeply and finely pre-
bred by plowing and harrowing. The soil best
suited to the beets is a light sandy loam, but
excessively rich in nitrogenous plant food but
not deficient in this respect. Upon heavy soils
the tubers are prone to crack because of the
uneven growth under varying conditions of
moisture and dryness. Plenty of moisture, warm situation and liberal manuring are essen-
tial. The ground is kept cleanly cultivated until
the vines interfere with tillage. The tubers are
dug in the autumn and stored in a great variety
of ways, all considered more or less unsatisfac-
tory since the tubers usually decay badly during
storage. While the plentiful yield may fre-
quently beg a market in the autumn, the demand
from mid-winter onward can rarely be supplied
even at advanced figures. These troubles may
be considerably reduced by proper care in har-
esting. The following practices are recom-
mended: Digging before the tubers start a
'second growth,' choosing clear weather when
the soil is dry, using padded baskets to reduce chance of scratching the tubers, handling so as
to avoid bruising; the sprouts of the crop are
shorn and giving perfect ventilation in the stor-
age heaps which should always be located upon
knolls or otherwise dry ground. As adjuncts to
these practices the beds in which the sprouts
are obtained usually are provided with fresh
manure and the plants should never be set two years in succession in the same
field; three or four years is considered much better. These are all preventive and are thought to be more valuable than special methods of storage in expensive storage quarters.

Consult Georgia Experiment Station Bulletin No. 25 and Farmers' Bulletin No. 26 of United States Department of Agriculture.

SWEET-SOP, the edible fruit of an evergreen shrub (Annona squamosa). It is ovate in shape, with a delicious sweet pulp, enclosed by a thick rind having projecting scales. Although indigenous to America this tree is cultivated for its fruits in all tropical climates, and is also called sweet-apple, or, in India, custard apple—a name which properly belongs to A. reticulata.

SWEET SULTAN, a plant. See Cen- 
taurea.

SWEET WATERS OF ASIA, a river, the ancient Aretas, flowing between Anadoli Hissar and Kandili, on the Asiatic side of the Bosphorus. The Turks call it Ghiok-suyu, "the water from the serpent," from the surpassing beauty of its surroundings. The valley is a favorite picnic resort in summer and autumn, when the better class Turkish families may be seen on Fridays (Mohammedan Sabbath) in their private canoes (boats) on the stream or scattered along the shores using luxuriant cypress, sycamore and plane trees.

SWEET WINES. See Wine and Wine Making.

SWELL-FISH. See Globefish; Diodon.

SWENSSON, Carl Aaron, American Lutheran theologian: b. Sugar Grove, Pa., 25 June 1857; d. Los Angeles, Cal., 16 Feb. 1904. He was graduated from Augustana College, Rock Island, in 1877, and in theology from Augustana Seminary in 1879; was secretary to the General Council of the Lutheran Church of North America in 1885 and its president, 1893-94. He was a member of the Kansas legislature in 1889; founded Bethany College in 1881 and was its president from 1889 till his death. He was the author of hymn books and books of travel in Swedish and English.

SWETE, swêt, Henry Barclay, English theologian: b. Bristol, 14 March 1835; d. May 1917. He was educated at King's College, London, and Gonville and Caius College, Cambridge, where he gained several prizes, and was graduated in 1858. He was professor of pastoral theology in King's College, London, from 1882 till 1890, and examining chaplain to the bishop of Saint Albans from 1881 till 1890; and after 1880 was Regius professor of divinity at Cambridge. He was made honorary chaplain to the king in 1911. His published works include 'Early History of the Doctrine of the Holy Spirit' (1873); 'History of the Doctrine of the Holy Spirit in the Prince of the Apostles' (1876); 'Commentary of Theodore of Mopsuestia on the Minor Epistles of Saint Paul' (1880-82); 'The Old Testament in Greek,' according to the Septuagint (1887-94); 'The Ahimma Fragment of the Apocalypse (1890-91); 'The Apostles' Creed in Relation to Primitive Christianity' (1891); 'Faith in Relation to Creed, Thought and Life' (1895); 'Church Service and Service-books before the Reformation' (1896); 'The Gospel According to Saint Mark, and the Greek Text' (1890); 'Notes and Indices' (1891); 'Introduction to the Old Testament' (1900); 'Patriotic Study' (1902); and in the Teaching of Our Lord' (1903) of the Ascended Christ' (1911); 'Spirit in the Ancient Church' (1912); Last Discourses of Christ' (1913); 'The Holy Catholic Church.' He also contributed articles to Wace's 'Dictionary of Christian (Vol. III and IV, 1882-87); and to 'Dictionary of the Bible' (Vol. II 1890-1900).

SWIFT, Gustavus Franklin, merchant: b. Sandwich, Mass., 24 June Chicago, Ill., 30 March 1903. At the he opened a small butcher shop in h town, but removed to Boston when he was 30 years old. He returned to Boston 1875 when he went to Chicago, where he developed the department of shipping to eastern markets. In 1877 he evolved the first refrigerator car, and dressed instead of live animals, which had a great effect on the cities. He was the pioneer in this business from the small plant started in the 1870s. He developed the great corporation bearing his name.

SWIFT, Jonathan, English cl prelate, political writer and satirist: b. Ireland, 30 Nov. 1667; d. Dublin, 19 (30 Apr.) 1745. Swift was the posthumous son of Richard Swift, the neer-do-weel of a prosperous family which had a number of descendants. His father was a famous member of Swift's house. Thomas Swift (b. 1595), the famous vicar of Goodrich. Through Thomas marriage to Elizabeth Dryden, great great-grandfather of Swift's relation to Swift's mother, Abigail Erick, of Leics was a distant cousin of Sir William 1 a woman of much character and wit. Swift's life divides itself into three periods: to the death of his mother, in 1699; from that year, to the age of 80; and the rest of his life in Dublin, where he almost continuously lived. The story is that he was taken at the one year from Dublin to Whitby, by his nurse, where he lived two years, to read in the interval. At the age of he entered Kilkenny School at the time of his uncle, Godwin Swift. Entering Trinity Dublin, in April 1662, he was graduated years later without distinction, and in 1665 was publicly censured for his studies and for tavern-haunting. His diet was probably much more than his studies and was friendless. His de on the charity of his relatives was his pride, and he was a happy, but the consequences were not very serious. Swift Ireland in the fall of 1688 by the real Tyrconnell, and he and his mother retired to Ireland, where in 1690, he became to Temple at Moor Park, near Londe.
position was a somewhat menial one, but his patron's kindness enabled him to take the degree of A.M. at Oxford in 1692. Returning to Temple but finding his position irritating, he refused the latter's offer to obtain for him a clerkship in the Irish Rolls, quarreled with his employer and entered the church. Ordained deacon in October 1694, and priest in January of the following year, he obtained the living at Kilroot, Ireland. Tiring of his position, however, he applied to Temple for reinstatement, and the latter, glad of his help, called him back to a post of greater importance, early in 1696. Here Swift remained till his patron's death in January three years later.

The decade ending with that date is very important to the life of Swift. Intellectually, he was very active and, besides his routine duties, did a prodigious amount of reading. Though he did not always understand his motives accurately, he was nevertheless not far from the truth when he described his temperament in a letter to a friend who had cautioned him to beware of ambition: "He was about to make. Protesting that he could have no thought of matrimony until his position in the world was secure, and adding that he was very hard to please, he continued: "How all that suits with my behaviour to the woman in hand you may easily imagine, when you know that there is something in me which must be employed, and when I am alone turns all, for want of practice, into speculation and thought; insomuch, that these seven weeks I have been here, I have writ and burnt, and writ again upon all manner of subjects, more perhaps than any man in England. And this it is which a person of great honour in Ireland (who was pleased to stoop so low as to look into my mind) used to tell me that my mind was like a conjured spirit that would do mischief if I did not give it employment." (To Rev. John Kendall, 11 Feb. 1691). Whatever may have been the exact truth of the matter, Swift's constitutional restlessness was aggravated by a malformation in the region of the ear, which resulting in blood pressure, caused the attacks of giddiness and deafness to which he was always subject and which drove him to intense activity for relief (consult Craik, Appendix, XIII, and Collin p. 237).

His first writings, however, were of no importance. Falling under the influence of Cowley, he produced his first extant poem in May 1699, a very stilted Pindaric Ode to Dr. William Sanrcoft, and the seven known poems, chiefly odes, which he wrote before 1698 are of no better quality; it was the fourth, 'To the Athenian Society' (1691) that, according to Johnson, caused Dryden's damaging remark, 'Cousin Swift, you will never be a poet.' His vein then suddenly changed, and in 'Lines written in a Lady's Ivory Table-Book' (1698) and 'Mrs. Francis Harris's Petition' (1700) he first displayed evidences of the graphic, humorous description and the complete absence of sublimity which distinguish his work.

Far more striking are the two works which opened his career as a prose writer. Among a probably large amount of writing now lost, he composed, in 1696, 'The Battle of the Books' and 'A Tale of a Tub,' both of which remained unpublished until 1704. The year 1696 may be taken as the date when Swift abandoned his efforts to imitate the writings of his patron, and leaped, full-armed, into his own peculiar and inimitable possession, satire. 'The Battle of the Books,' the one piece now read in a once famous controversy, in which Temple had engaged, as to the relative merit of the Ancients and the Moderns, is famous for its satire, affectation, pedantry and obtuseness and for its lively burlesque of the heroic manner. The other book, a much more elaborate affair, by many regarded as Swift's masterpiece, is in its narrative parts a satire against religious abuses and schism, in the persons of Peter, the Church of Rome, Martin, the Anglican Church, and Jack, the Presbyterian sect. This narrative, however, comprises no more than a third of the book; the remainder is taken up with digressions, prefaces and digressions, which variously satirize the vanity, conventionality and affectation of authors, the irreverence and surliness of the wits of the day, the pedantry, the cheapness and superficiality of contemporary learning, and, in greater fear than hope, vanity and emptiness. In these two books, written before he was 30, Swift showed himself to be an unrivaled master of irony, burlesque and satire.

In the summer of 1699 Swift became secretary and chaplain to Lord Berkeley, one of the lord justices of Ireland. Disappointed in his efforts to obtain the deanship of Derry, he was made in February 1700 vicar of Laracor, Agher and Rathbeggan, in County Meath, Ireland, livings worth about £200 a year. On the resile of Berkeley in 1701, he went with the latter to London and published his first political pamphlet, 'The Dissensions in Athens and in Rome,' an attempt to show the need of harmony in politics. Though the pamphlet gained the goodwill of the Whigs, Swift's work for the next nine years was wholly in behalf of the Irish clergy. Four journeys to London, of an average duration of over six months apiece, were undertaken chiefly with a view to obtaining remission of the taxes on the Irish livings, and during the same period Swift wrote a number of able pamphlets in support of the established church, of which the masterly piece of irony, 'An Argument to Prove that the Abolishing of Christianity in England may, as this is understood, be attended with some inconvenience, and perhaps not produce those many good effects proposed thereby' (1708), and 'The Sentiments of a Church of England Man, with respect to Religion and Government' (1708), are the most important. During these visits also, Swift came to know the best wits of the time, the chief literary result of which were the famous 'Bickerstaff Pamphlets' (1709-10), a practical satire against false learning in the person of the astrologer Partridge. His principal purpose, however, came to nothing; he was put off by the Whig lords, and, personally disappointed because of his failure, owing perhaps to the impression created by 'A Tale of a Tub,' to gain preferment in the Church, he gave his services to the Tory ministry which came into power in 1710.

During the next four years Swift wrote an extraordinary number of political pamphlets; few political writers have ever done a larger amount of brilliant and powerful work. Swift's
task was threefold: to show that the cause of the Tory ministry, its desire to obtain a peace with France, was a just cause, and that its members were worthy men; to cast ridicule on the pretensions and perfidies of Whig; and to restrain the more violent Tories from extreme measures. His first work, after a caustic "Short Character of Thomas, Earl of Wharton" (1710), was the conduct of the Examiner, the organ of the Tory party, which he had between 2 Nov. 1710 and 14 June 1711, contributing a series of varied and able arguments and satires. His position, maintained with singular adroitness, was that the country was crying for a peace and happiness which could be more readily obtained from the Tories than from the Whigs, especially while Marlborough and Wharton were influential. In "The Conduct of the Allies and of the Late Ministry in Beginning and Carrying on the Present War" (November 1711), commonly regarded as his masterpiece among the writings in support of the Harley administration, his object was to strip the war of its glamour and to render it unpopular by showing that the Allies, the constituent parties of the Whigs, had been systematically exploiting England. After ten years of war with perpetual successes, he says in his preface, "to tell us that it is impossible to have a good peace is truly mioptrical—and it is natural to inquire into our present condition; how long we shall be able to go on at this rate; what the consequences may be on the present and future ages; and whether a peace, without that impracticable point which some people do so much insist on, he really ruinous in itself, or equally so with the continuance of the war." Other important tracts were "The Importance of the Guardian Considered" (1713), a merciless, but not unprompted attack on Steele, and the savage and fairer answer to Steele's "Crisis," the very skillful "The Publick Spirit of the Whigs." Besides his political writing, Swift published many pieces of a miscellaneous kind, including several papers for Steele's Tatler, at least one for the Spectator, some controversial satires on religious subjects, his historically interesting but philologically unsound "Proposal for Correcting, Improving, and Ascertaining the English Tongue" (1712), and the well-known "Journal." He became acquainted with the acquaintance of Esther Johnson, then a child of eight, during his first residence at Sir William Temple's, and had been the tutor to this ward of his patron. When he got his livings in 1700, she, with her companion, Mrs. Dingley, went to Ireland to live near him, and during his residence in England remained in Ireland. The "Journal" extends from 2 Sept. 1710 to 6 June 1713, with scarcely a break. The letters, which were dispatched every two or three weeks with an entry of the events of the day, were the personal and character of a busy and influential man of the time.

As a reward for his great political services, Swift was appointed, on 23 April 1713, dean of Saint Patrick's Cathedral, Dublin, and the following year to Ireland, at the charge of his new office. Returning to London in August of the same year with a view to healing the growing breach between the Tory ministers, Oxford and Bolingbroke, he was unsuccessful and returned to Letcombe, Berkshire. On the fall of Oxford and the triumph of Bolingbroke, Swift wrote "The Progress of Praise" (1713), and saw the close of his political career in England. On the death of Queen Anne, 1 Aug. 1714, the downfall of Bolingbroke and the complete triumph of the Whig party, he returned at once to Dublin, where he remained continuously for the next 12 years.

In Ireland he found himself very unpopular, and in his Church had trouble with his chapter and the archbishop, King. For the next six years he lived quietly, busying himself with his duties and writing only a few pieces, chiefly short letters of advice, articles on manners, etc. In 1716 he may have married Stella. The evidence is conclusive neither way, but the probability is against the marriage. At all events, she continued to live near him till her death in 1728, an event which caused him profound sorrow. Of the various, and occasionally heated, discussions that have arisen about this famous love story, the conclusion of Sir Leslie Stephen to the effect that the question is not practically important in determining the character and achievement of Swift. In 1720 Swift again became active. For the next 18 or 20 years, until he would no longer, his very voluminous production has three main aspects: that in behalf of the oppressed people in Ireland, both clergy and laity, that for the doctrines and the establishment of the Anglican Church; and the miscellaneous humorous and satirical writing, both in prose and verse, on which his popular literary fame largely rests. Beginning with a "Proposal for the Universal Use of Irish Manufactures" (1720), he followed his usual tracts on other subjects, and in 1724 began his most celebrated piece of polemic writing, "The Drapier's Letters." These very powerful, effective, but not wholly fair pamphlets were occasioned by a patent which had been issued to one William Wood to coin 100,000 of copper or silver coins in Ireland. Swift, in the first three letters, addressed the people of Ireland, under various classes, and with much skill in the selection of arguments suitable to each class, advising them to shun the coinage which the English government was trying to foist upon the Irish public. Then, having prepared his ground, he launched forth, in the next three letters, against the general right of the English to exploit and oppress the Irish. He closed the series with a letter, not published till 1735, "An Humble Address to both Houses of Parliament," in which he powerfully reviewed the woes of Ireland and made proposals for remedying them. The letters caused great excitement: the printer was arrested and a new trial of the law for the apprehension of the writer; but they produced their effect and the coinage was refused. Swift became very popular, and his position enabled him to pursue the subject of his last letter in many other acts. The unstable condition of Ireland is the burden of his political song, in such able pieces as "A Short View of Ireland" (1727), and "Maxims Controlled in Ireland" (1728).

The most remarkable of these public pieces is the very extraordinary and able "A Modest Proposal for Preventing the Children of Poor People in Ire-
Swift, in his maturity, is represented in the several extant portraits of which those by Charles Jervas are the most interesting, as a man of large frame and handsome countenance. Contemporary accounts represent him as a man of much distinction of manner and powerful presence, and above all as intellectually among the greatest of his time, and his influence was uncommonly great. From the time of the 'Draper's Letters' he exercised a remarkable sway over the affections of the
SWIFT.—SWIFT CREEK

Irish, and is said to have been the most popular man in Ireland. By his friends he was greatly beloved and the charm which his personality has exercised on most of his biographers has frequently made them protagonists and led them to minimize some evident defects of his. Each in his mercilessness to his opponents and his not infrequent coarseness, defects which he shared with many of the ablest men of his time.

Among all the able writers of the age he is surpassed by none in range and power and by none, except Defoe, in voluminosity. His known writings comprise over 230 separate prose titles, varying in length from the 'Meditations on a Broomstick' to 'Gulliver's Travels,' upward of 300 poems and some 500 letters. Within the limits of his style, which may be defined as the simple, intense and unadorned, as opposed to the ornate or the sublime, he is complete master of his medium and his sureness of touch in the large number of varied subjects that he treated, give him a place among the greatest of his era. Neither philosophical intricacy nor emotional appeal interested him, but as master of simple, racy English, of irony, humor, burlesque, satire and invective, he is unsurpassed, as he is also in his management of the topics with which he deals. Though he is remembered in literature chiefly for his great satires, nearly all the titles cited in the foregoing columns are models of their kind in writing. See Battle of the Books: Gulliver's Travels; Tale of a Tub; and Bibliography.—The best editions of Swift's complete writings are still those of Sir Walter Scott in 1814 and 1824 (2d ed.) in 19 vols. The most convenient and accurate modern edition of the prose is by Mr. Temple Scott (begun 1898) in 12 vols. of the Bohn Library. Other editions and selections of his prose and verse are too numerous to mention specifically. The principal early biographies are Orrery's 'Remarks on the Life and Writings of Swift' (1752), Delany's 'Observations' (1754), Dean Swift's 'Life of Jonathan Swift, the Life, Writings, and Character of Dr. Jonathan Swift' (1755), Hawkesworth's 'Memoirs' (1755), Johnson's in the 'Lives of the Poets' (1780), Thomas Sheridan's 'Life' (1784), Monck-Berkeley's 'Enquiries into the Life of Swift' (1791), John Barrett's 'An Essay on the Earlier Part of the Life of Swift' (1898), Sir Walter Scott's 'Memoirs' (prefixed to the edition of the works), all of which tell much the same story. Scott's is the best. Monck Mason's 'History and Antiquities of Saint Patrick's Cathedral' (1810) contains much interesting and valuable matter. The more modern and authoritative lives begin with John Forster's 'The Life of Jonathan Swift, 1667-1711' (1875), unfortunately unfinished. The most complete and accurate life is, on the whole, that by Sir Henry Craik (London 1882). Sir Leslie Stephen's in 'The English Men of Letters' is also good. Other lives are the enthusiastic study by J. Churton Collins (1893), the less interesting 'Dean Swift and His Writings' by Anthony Munday (1893) and the introduction to the British Edition by W. F. H. Leckey. Consult also Smith, S. S., 'Dean Swift' (New York 1910); 'Correspondence,' edited by F. F. Bell (ib. 1914) and 'The Bibliography of the Writings of Jonathan Swift' (in 'Prose Works,' Vol. XII, New York 1908); Historical Review (March 1918).

Professor of English, Columbia U.

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road between Richmond and Petersburg, large part of the 10th and 18th corps Gillmore and W. F. Smith moved out morning and destroyed the road from Swifts from the north for some distance, a distance of six miles. Arriving at k and driving the Confederate skirmish-ness it, the Federals found that the stream fordbale and that the bridges were held od's and a part of B. R. Johnson's, with artillery posted on the south bank, was a sharp engagement across the with artillery and infantry, in which le lost about 150 men, and on the morn- the 10th the expedition returned to la Hundred. Consult "Official Record" (XXVI).

IPT-MOTHS, a cosmopolitan family "tidae) of large or medium-sized moths, erized by brownish or golden wings, ex-

IPTS, birds of the family Micropodidae "sleep"), noted for the extreme rapidity

of the place in the system

ology has been much discussed. For-

were universally classed with the s, but the usual opinion among ornithol-

I have a generally swallow-like aspect. l is very small, flat and weak, but the

which is not provided with bristles, extr

back beneath the eyes, giving a very eopen. Just at its base above are the partially covered by feathers. The feet small without any distinct scaly cover-

they present

ible peculiarities in the position of the d and the number of phalanges in the dif-
genera. The wings are extremely long, r far beyond the tail and crossing, but h lies entirely in the extremely clon-

quills, the upper segments of the d the secondary quills being unusually In the typical swifts the tail is long and in others it is short, truncate and there are always 12 retices. Amongal characters swifts have the salivary markedly developed and of the mucous e lower intestine has no ceca; the skull stigpoid processes in those which e palate of the passerine (agithognath-

pe has been combined with the ate (shizognathous) type; the keel of nium is remarkably deep and the pectoral correspondingly well developed. Ex-

they shun the polar regions these insectivorous birds are cosmopolitan in trition. There are about eight genera species divided into the subfamilies of dau-

spine-tailed swifts. The first has the hers normal, the tarsi and toes feath-

hind toe capable of being turned later-

ally or forward and the three front toes with only three joints each. Nearly all of the species of this group belong to the Old World, several being South American, and one belonging to the United States. In C. niger and C. ater, the feathers are directed forward. To this genus belongs the common swift of Europe (C. apus) and the Alpine swift (C. alpinus). The only representative of this group occurring within the United States is the white-throated rock swift (Aëronautes melanoleucus), found in the southwestern region north to Wyoming and in winter in Mexico and Central America. The hind toe is directed laterally, not forward, and the toes are only partially feathered. The colors are black above with some white mark-

ings and white below; the length about seven inches and the closed wing the same. This species is gregarious and nests in extensive colonies in holes and on ledges of inaccessible cliffs. Like the European swift its flight is incredibly rapid. Among other similar true swifts, none are of greater interest than palm swifts (Tachornis) of Africa and the tropical Orient and the aberrant tree swifts (Macrop-
teryx) of India and Ceylon, which nest in trees.

The subfamily Chatsurinae has the feet more normal, but the hind toe is more or less versa-
tile and the phalanges of the front toes, though not reduced in number, are extremely short; the feet are unfeathered and the tail feathers have the vane wanting at the end, the produced shaft forming a stiff mucronate tip. The common chimney swift (or erroneously swallow) (Chatsura pelagica) is an example, and is too well known to require a description. It is a migratory species and one of the very latest birds to appear in summer. It breeds as far north as Labrador and winters southward to southern Mexico. Its western limit is the cen-

tral plains. This is one of the birds which has been reputed to hibernate at the bottom of ponds and not a few circumstantial accounts of the manner in which they entered the mud have been published. Several patient, truth-loving, zoologists have carefully investigated these reports with the expected result that they proved baseless. The nests of this swift are interesting structures of twigs glued together under a thick coating of hard varnish-like dried saliva, which also serves to attach the saucer-like struc-
ture to the inside of an unused chimney, which at the present time are the almost exclusive nesting and sleeping sites of these birds. Formerly they occupied hollow trees and still do in unsettled parts of the country. The eggs are pure white and number four or five. Most of the life of these birds is spent in flight, and many and remarkable are their aerial perfor-
mances. The only other swifts of this sub-

family inhabiting the United States are Chatsura vanuvi of the Pacific States, there replacing the eastern chimney swift, and the black swift (Cypseloides niger) of the Rocky Mountain region and westward from British Columbia to Central America. It ascends to great altitudes. Several species of the latter genus occur in South America. Callioptia includes the edible birds'nest swifts (q.v.) of which a number of species occur in southeastern Asia to Madagascar and the Marquesas. Consult, besides the articles referred to above, and the standard works on American
Ornithology, especially Hartert, 'Catalogue
Birds British Museum' (Vol. XVI, London
1892) and 'Cambridge Natural History' (Vol.
IX, New York 1907).

SWIMMING, the art or practice of loco-
motion or mode of progression in the water
by using the arms and legs as paddles. Ac-
cording to the best authorities, all animals, ex-
cepting man, monkeys and, perhaps, the three-
toed sloth (Bradypus Tridactylus), either swim
naturally or go through the motions of swim-
ing when suddenly immersed in water. There
are, however, a number of animals that, al-
though they swim naturally, drown as they
swim. This is the case with rabbits, mice,
moles and the smaller cats. Drowning appears
to be the result of the fur being saturated.
Tigers, cheetahs and lions, the larger cats, are
fine swimmers. It is noteworthy that the mole
and the rat are equally strong swimmers, the
former, however, drowns in a short time, while
the latter has considerable endurance in the
water and is credited with many feats of long-
distance swimming.

The conditions under which an animal will
swim well are those in which the wetted sur-
faces are large, the more so, the greater the
power of resistance, and where the specific
gravity of the object is a little greater than
that of water and consequently subject to the
least disadvantageous displacement. Almost
all of the larger quadrupeds, especially the deer
and the horse, are exceptionally fine swimmers.
They simply walk in the water, the motions
which serve to support and propel them in
that medium being very similar to those em-
ployed to progress on land.

On the other hand, in the swimming of man,
it is necessary to consider a semi-artificial
mode of progression, which is, however, sub-
ject to and regulated by the general laws gov-
erning aquatic locomotion in relation to the
medium, the body immersed therein and to
the forces exerted by that body to propel itself.
The human body with a normal amount of air
in the lungs is very slightly lighter than water
and the movements of the limbs produce various
effects, according to the direction of the effort.
When the limbs are carried horizontally and down-
ward they tend to support and propel the
body. When they are moved in an upward
direction, as in diving, the body is given a
tendency to descend. As to the immersed sur-
faces, their direction tends to either float or
sink the body. When a man wishes to float
in the water he assumes a flat position resem-
bning the natural position of the lower swim-
ing forms and for purposes of propulsion and
support employs the "dog paddle," in which the
motions of the hands are exactly similar to
those of the forepaws of a dog in swimming or
in walking; a method of swimming em-
ployed naturally by almost all land animals.

In many men's initial efforts to swim re-
sult in positions of the body and motions of
the limbs which closely approximate to those of
the lower animals that swim naturally, he has
adopted and developed artificial methods by
the use of which he surpasses them in speed
and endurance.

These methods involve motions of the limbs
which may be conveniently designated as the
breast or front stroke, the side stroke, the
overhand stroke, swimming on the back,
floating and treading. In general, so
the arms and legs move in any direct
forces exerted tend to propel the b

![Fig. 1.—Breast Stroke.](image)

The breast stroke consists of a brush
of the arms in a horizontal plane, ac-
bored by a frog-like motion of the legs. It
is effected by placing the hands with
upward, the wrists being bent sideways
the fingers point to the front and
sides of the wrist joints touching
about four inches below the surface
water. The arms are then pushed geo-
ward, the palms being kept flat and the
fingers pointing to the front and
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the deeper immersion of the head reduces its weight and relieves, somewhat, the strain of its support from the muscles of the neck. If on the right side the right arm is thrown out in front with the palm of the hand turned downward and kept level with the under side of the head. It is then pushed out to its full extent, kept rigid and without bending either the wrist or the elbow, is brought down through the water in a strong movement until the hand at full stretch comes between the legs. It is then brought up along the body to the chin and the stroke repeated. The left hand, formed into a scoop, is turned outward by the wrist at right angles to the forearm and the left arm, with elbow bent, is thrown outward and executes a straight pulling stroke to the left hip. The arms act alternately and when one is executing the positive, the other is at the negative part of the stroke. The action of the legs should be long and powerful and coincident with that of the arms and shoulders. When the right arm finishes its downward stroke and the left arm is extended in front, the legs are drawn up to the body. When the left arm pulls downward, the legs are opened wide, swung around and closed, in one continuous motion. Care is taken never to cross the legs, make any effort to raise or sink the head, or exert any sudden pull at any part whatever of the complete stroke.

In the overhand stroke, all the movements excepting those of the upper hand and arm, are similar to those of the side stroke. The left or upper arm is brought forward and extended as far as possible out of the water in front of the head, then dipped and pulled through with a strong propelling stroke. The method gives a more lengthened reach and when properly acquired, is the most useful and easy of all the various methods of swimming; but the side stroke is the one generally employed in long-distance racing.

One of the fastest strokes for short-distance swimming is the Trudgeon stroke, introduced into England a few years ago from the South Pacific. The action of the arms consists of alternate overhand strokes, while the legs made a frog kick simultaneously with one of the arm strokes, with the body swimming on the belly. A modification of this style was introduced a few years ago by Meffert, the American mile champion, and has been adopted by some of the best American swimmers. In it the head and the forearm are kept submerged when the body is being pushed forward and the face is brought out of the water to breathe, by a turning action of the waist as the forward movement checks between the strokes. This style prevents a cramped position of the head and also allows a freer action of the body. Many racing swimmers take a breath only every other stroke, keeping the face half under water half of the time.

Swimming on the back is accomplished by lying in the water back downward, the hands resting on the waist, the elbows directed outward, the breath held and the chest expanded. To propel, the legs are bent and the feet are drawn up close to the trunk, the knees being directed outward with the heels close together. The legs are now struck out as wide apart as possible and then brought closely together until the great toes, inner ankles and the inner sides of both legs meet along their entire length. Greater speed may be obtained by extending the arms outward and on a level with the
body, the palms facing downward and using them as sculls. Diving, when well performed, is a very graceful feat. The dive may be a standing or a running one. To make a good dive, the feet line and legs are kept close together, the chest inflated and the arms are swung back and forth two or three times. The lungs are then charged with a long, deep breath, and the dive is made just a moment before the arms and hands are raised over the head. In springing off, all the power of the legs is used, and in mid-air the body is straightened out like an arrow from the tips of the fingers to the toes. The arms are then declined so as to enclose the head, the chest is contracted for an instant and the water is entered noiselessly and without a splash, fingers first. The moment the body is covered, the head and arms are thrown up, which brings the diver to the surface. The eyes, which instinctively close as they enter the water, should be opened under the water, in order to avoid accidents.

Floating is the position assumed by a swimmer to rest. It is accomplished by holding the forehead below and the mouth and chin above the surface of the water. The arms and legs may be stretched out as far apart as possible, as in the spread eagle position or the body may be held rigid and straight with the legs crossed, the lower part of the face and the toes peeping above the water and the arms either lying at the sides or above the head with the thumbs locked.

Treading water is a method employed to maintain a perpendicular position in the water, the head being kept above the surface. It is accomplished by paddling with the hands and working the legs and feet as if going up stairs, with the soles of the feet acting as sustaining surfaces. It is the only branch of the art that approaches natural conditions and if resorted to in cases of accidental immersion, would prevent 75 per cent of the deaths due to that cause.

Expert swimmers are capable of dispensing with the use of the arms, and when treading for display, or in competitions, either hold their arms and hands above the surface or fold them across the chest. They are also capable of floating with both legs or both arms out of the water, spinning like a top while maintaining a sitting position; taking off the clothes on the body; taking off the stockings and cutting the toe nails, all of which illustrate man’s command over the attending artificial conditions.

Aids to increase speed may be employed in the form of wooden plates which are attached to the palms of the hands and the soles of the feet. The most effective are those invented by R. H. Wallace Dunlop and introduced in England in 1876. Other helps, for sustaining purposes, have been employed from very early times. They were generally in the form of flat surfaces of wood, tin and water-proof fabrics, but their use is not recommended.

The Amateur Athletic Union of the United States holds championship swimming competitions in various places every year. The Hawaiian Association has a very large following and holds numerous contests. There are also intercollegiate, metropolitan and many local competitions.

A general idea of the speed and endurance of swimmers may be obtained from a few of the best performances on record: 100 yards—P. McGillivray (American amateur), 54s. (in bath); D. P. Kah’oku (American amateur), 53s. (in open water); A. Wickham (Australian professional), 1m. 4s. (in open water).

One mile—D. Billington (English professional) 24m. 11½s. (in open water); B. Kieren (Australian amateur), 23m. 16½s. (in bath); G. R. Hodgson (Canadian amateur), 23m. 34½s. (in open water). Woman’s record—Fannie Durack (Australian), 26m. 8s.

Long-distance swimming—Webb, 40 miles with tide, 9h. 57m. 00s.; Mercadier, 20 miles with current, 4h. 59m. 46s.; Miss Agnes Beckwith, 20 miles with current, 6h. 25m. 00s.

Long immersions—Webb, 20 miles, increased to 35 miles by tides, crossing the English Channel, 21h. 45m. 00s.


SWIMMING BLADDER, AIR-BLADDER, or SOUND, an internal sac-like organ in fishes by which they regulate their relative buoyancy. See Fish.

SWINBURNE, Algernon Charles, English poet: b. London, 5 April 1837; d. 10 April 1909. He was the son of Admiral Charles Henry Swinburne, of an old Northumbrian
and Jane Henrietta, a daughter of the 1 of Ashburnham, a woman of high who exercised a marked influence on the actual development of the poet during his early years. From Balliol e, Oxford, where his time was chiefly devoted to the study of Greek poetry and in less of the literatures of France and Italy. ofte, also, for the Undergraduate Papers, edited for him, and he was among the first to give a considerable body of verse which, however later characterized as worthless. He xford in 1860 without taking a degree, for a short time on the Con visiting Walter Savage Landor in 1861, for whom he entertained a great ad-

The year of his leaving Oxford was 1858, on the publication of 'The Queen of Sheba,' and 'Rosamond,' which, written in iambic tetrameter, revealed little metric and aroused practically no attention. In winburne settled in London, in the house of Rossetti. In 1865 appeared his first volume of verse, 'Atan Calydon,' which was hailed as giving evidence of his being the best writer of the time. 'Atalanta,' six volumes of verse of which he had earlier attained, does not go. These works are 'Centuries of Roundels,' 'Stanzas,' 'Lonicera,' a tragedy (1885); 'Lonicera,' a tragedy (1887); 'Poems and Ballads,' a selection (1889); 'The Sisters,' 'Lodore,' 'The Tale of the Brothers,' and 'Rosamond, Queen of the Lombards,' which were Balen's, of these Balen perhaps ranks nearest to the great works of his earlier period.

Swinburne also wrote much prose, in the field of criticism, possessing many of the characteristics of his verse, vehemence, imagery and lack of self-restraint. Although he possessed the gift of the illuminative phrase and displays at times a profound insight, his criticism as a rule shows no refinement of judgment. It was his avowed conception of the mission of criticism not to weigh narrowly and to examine minutely, but generously to praise. But though Swinburne was so far unique to his position in his regard as a poet, as well as loved, he hated and loved with unrestrained passion. He wrote eulogies on 'Charlotte Brontë' (1877), 'Shakespeare' (1880); 'Victor Hugo' (1886), and 'Ben Jonson' (1889). To Robert Buchanan's assault on the 'Fleshy School of Poetry,' including Swin burne, Rossetti and Morris, the first replied in his scathing 'Under the Microscope.' Among his other works of criticism are 'Essays and Studies' (1875); 'Miscellanies' (1886), and 'Studies in Prose and Poetry' (1884) and his position should also be made of 'The Modern Heptalogy,' a volume of parodies on contemporary poets, which appeared anonymously in 1881 and has not been, as yet, officially acknowledged as a work of Swinburne. His it was, however, by common consent and that in spite of the fact that among the most amusing burlesques is the one on himself. Swinburne's position in English literature is to be assigned him on his merits as a master of verse form and poetic rhetoric. With no essential profundity of thought, with no definite theory of life, with no deep insight into human character, he stood pre-eminent as a molder of
exquisite melodies. It is his manner that should give him a permanently high rank among English poets. (See ATALANTA IN CALYDON. Consult Wateslaw, Theodore, 'Algernon Charles Swinburne, a Study' (London 1900); Sheeherd, R. 'Chimneys of Swinburne' (1887); Mackail, J. W., 'Swinburne' (Oxford 1909); Thomas, Edward, 'Swinburne' (New York 1912); Drinkwater, John, 'Swinburne: An Estimate' (ib. 1913); Woodberry, G. E., 'Swinburne' (ib. 1905).

SWINDON, England, in Wilts., 29 miles northeast of Bath and 76 miles west of London, consists of two parts — old and new Swindon. The older section on a hill is picturesque and its principal buildings comprise the parish church, town-hall, assembly rooms and corn exchange. The new town on reclaimed lowland contains a mechanics' institute, theatre, etc., the railroad shops of the Great Western Railway employing several thousand men and an extensive park connected with these works. The town is an important railway junction. Pop. 50,751.

SWINE. General Information.—Swine are of immense importance in the commerce of the world. In the United States alone there are some 65,000,000 of swine on the farms and in the hamlets. This figure some two-thirds of a hog for every human being in this nation.

Swine products are many and various, fats, particularly lard, is one of the chief production. A real fat hog produced on corn in the pastures of the corn belt may yield as much as 50 pounds of fat in every hundred pounds of his live weight; hams which are eaten fresh, boiled, fried, cured with hickory and other smokes, are relished the world over; bacon, the toothsome breakfast dish of Anglo-Saxons, has no substitute; sausages; spare ribs; pepsin extracted from pigs' stomachs for the medicinal doctoring of human stomachs; the bristly coat is used for brushes and as filler for cushions; the bones are ground for fertilizer; the hide is made into leather; in truth every ounce is utilized, nothing goes to waste.

The source of the hog is shrouded in considerable mystery, although the true swine, the wild boar and his kind (Sus scrofa), probably domesticated continent. Fossil remains have been found in Europe and India although not on the North American continent. The Pecaries found in Mexico and other southern countries are not to be confused with the true domesticated hog that is of such great commercial value. The Pecary is of American origin. The historic swine, therefore, that gave rise to the present common hog may be basically considered as the wild boar (Sus scrofa) with which was infused in the early days the swine of China, Japan and eastern Asia (Sus Indicus). An eminent Chinese scholar estimates that swine were domesticated in eastern Asia about 2000 B.C., whereas the European records indicate a period of domestication about 1500 B.C. To these early efforts of the human race we owe much for the improvement and development of the now-a-day swine.

The flesh of swine has been used by all peoples, apparently who came in contact with them. The Chinese, as we know, were adepts of the fine art of preparing and serving pork.

Pork is of particular advantage to civil peoples in that it can be preserved by salting and other forms of curing so that may be kept in edible condition for many years. Hams rightly cured appeal more to the epicure as the years unfold, so that five and six years from the "culling" are particularly appetizing. In the ordinary consumption of pork, however, hams seldom remain a first birthday before being eaten.

And smoked meats from the pig are enjoyed by the world and many a nation considerable of its prosperity to its commerce.

Types and Breeds.—The do is to an entirely different from his wild Forcious and species to the advantage. We have, therefore, two different types, one the so-called bacon and the other the lard hog. Naturally the bacon hog is fine for bacon, and the lard hog is primarily of American lard hog. The former is developed simultaneously with Indian corn as a feed for the swine. The flesh of the pig's metabolism into the lard and the belt pork sausages. Denmark, England and Canada are all good bacon type regions. Denmark principally because of her milk products and England because of her excellent pastures and cereals and Canada because of her cereal grains and milk products.

Contrast the original wild hog with every-day American lard hog. The wild hog is narrow, more like one's hand viewed from the front, but the lard hog is wide in the rear. In fact, in the contrast; the former is relatively small in comparison. In short, the lard hog is not only wider and larger, but longer, better \( n \) shorter nosed, shorter \( c \) longer, more muscular, more \( f \) in body, shorter tusked and not nearly so ferocious and spirited and of less use as an animal. Too, the lardhog has a better quality of meat and a higher proportion of the most highly valued cuts of meat in proportion to the total weight, this being marked in the development of the lard hog and lard hogs, the result of the selected and persistent selection of these animals for breeding purposes that most nearly approached the desired type. This has been possible in the years of endeavor to develop such a contrasting type. The development of this lard type is more remarkable in that the very characteristics which make up this type are supposedly inimical to the best health and bodily interests of the hog. Too much fat decreases vigor and vitality, and we are not surprised to find that the hogs which are large, robust, and vigorous, because they are not unduly fattened in truth the general selection in this bacon pro-
1. The Iowa Community Sunlit Hog House. Here is a new kind of hog house—one substantially but economically built for swine. It is a sanitary, economical and serviceable house of pleasing appearance.

2. The system of feeding is responsible for the difference in size—the large shote had all the corn he wanted on alfalfa pasture, and the little one only one-fourth of a full ration. It pays to feed swine liberally.

3. The self-feeder method of feeding grains is efficient.

4. The Iowa Movable Sunlit Hog House, well lighted, sanitary, convenient, economical, serviceable and durable.
1. Land type — the Chester White — a white breed

2. A lean type — the Poland China — Note black color and white mantle

3. A lean type — Yorkshire Gilt — a pure white breed
ducing business has been to develop muscular tissue, the chief emphasis being placed on its proper distribution with some, not too much fat, to make the most acceptable slab of bacon and the nicest *trimmest* hams, hams that do not require *too much trimming away of the fat*.

The typical bacon breeds are Tamworths and Yorkshires. The Berkshires may be so classed because they yield the highest quality of bacon, but the Berkshire is sometimes placed in the general purpose class, good for bacon and good for lard. Then there is the Large Black of England.

The typical lard type breeds are Poland China, Chester White, Duroc Jersey, Victoria, Cheshire, Essex and Suffolk.

The general purpose breeds may be classed as the Berkshire, Hampshire, Mule-Foot and possibly the Middle White.

The score card method of teaching judging is in vogue in all of our leading agricultural colleges. A number of points make up the total, or the ideal, and the relative emphasis to place on the different parts is indicated by the number of points as given for perfect. Below are given representative score card values as used by the Iowa State College at Ames, covering the bacon and lard types in the barrows. The relative descriptions show where the emphasis is placed in each type.

**BACON HOGS.**

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**SCALE OF POINTS — FOR BARROW**

<table>
<thead>
<tr>
<th>Description</th>
<th>Points</th>
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<tbody>
<tr>
<td>General appearance:</td>
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<tr>
<td>1. Weight, 170 to 200 pounds, the result of</td>
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<td>2. Pern, long, level;</td>
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<tr>
<td>3. Quality, hair fine; skin thin; bone fine;</td>
<td>10</td>
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<td>4. Condition, deep, uniform covering of flesh,</td>
<td>10</td>
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<tr>
<td>5. Head and neck:</td>
<td></td>
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<tr>
<td>6. Snout fine</td>
<td>1</td>
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<tr>
<td>6. Eyes, full, mild, bright</td>
<td>1</td>
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<tr>
<td>7. Face, short, cheeks full</td>
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<tr>
<td>8. Ears, fine, medium size, soft</td>
<td>1</td>
</tr>
<tr>
<td>9. Jowl, strong, neat, broad</td>
<td>1</td>
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<tr>
<td>10. Neck, thick, medium length</td>
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<tr>
<td>Forequarters:</td>
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<td>11. Shoulder, broad, deep, full, compact on top</td>
<td>6</td>
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<tr>
<td>12. Legs, straight, short, strong; bone clean;</td>
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<tr>
<td>13. Body:</td>
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<td>14. Chest, deep, full girth</td>
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<td>15. Back, medium and uniform in width</td>
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<tr>
<td>16. Sides, long, smooth, level from beginning of shoulders to end of hindquarters. A side at all points should touch a straight edge from fore to hindquarter.</td>
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<tr>
<td>17. Ribs, deep, uniformly sprung</td>
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<tr>
<td>18. Belly, trim, firm, thick without any fibbiness or shrinkage at flanks</td>
<td>10</td>
</tr>
<tr>
<td>Hindquarters:</td>
<td></td>
</tr>
<tr>
<td>19. Hips, wide, short, wide; proportionate to rest of body</td>
<td>2</td>
</tr>
<tr>
<td>20. Rump, long, even, straight, rounded toward quarters</td>
<td>2</td>
</tr>
<tr>
<td>21. Glansion, firm, rounded, tapering, fleshed deep and low toward hocks</td>
<td>8</td>
</tr>
<tr>
<td>22. Legs, straight, short, strong; feet medium size; bone clean; pasterns upright</td>
<td>2</td>
</tr>
<tr>
<td>Total:</td>
<td>100</td>
</tr>
</tbody>
</table>

---

**LARD OR FAT HOGS.**

**SCALE OF POINTS — FOR BARROW**

<table>
<thead>
<tr>
<th>Description</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>General appearance:</td>
<td></td>
</tr>
<tr>
<td>1. Weight, score according to size</td>
<td>6</td>
</tr>
<tr>
<td>2. Pern, long, level;</td>
<td>10</td>
</tr>
<tr>
<td>3. Quality, hair silky; skin fine; bone fine;</td>
<td>10</td>
</tr>
<tr>
<td>4. Condition, deep, even covering of flesh and fat over all parts of the body</td>
<td>10</td>
</tr>
<tr>
<td>Head and neck:</td>
<td></td>
</tr>
<tr>
<td>5. Snout, medium length, not coarse</td>
<td>1</td>
</tr>
<tr>
<td>6. Eyes, full, mild, bright</td>
<td>1</td>
</tr>
<tr>
<td>7. Face, short, cheeks full</td>
<td>1</td>
</tr>
<tr>
<td>8. Ears, fine, medium size, soft</td>
<td>1</td>
</tr>
<tr>
<td>9. Jowl, strong, neat, broad</td>
<td>1</td>
</tr>
<tr>
<td>10. Neck, thick, medium length</td>
<td>1</td>
</tr>
<tr>
<td>Forequarters:</td>
<td></td>
</tr>
<tr>
<td>11. Shoulder, broad, deep, full, compact on top</td>
<td>6</td>
</tr>
<tr>
<td>12. Legs, straight, short, strong; bone clean;</td>
<td>2</td>
</tr>
<tr>
<td>13. Body:</td>
<td></td>
</tr>
<tr>
<td>14. Chest, deep, broad, large girth</td>
<td>4</td>
</tr>
<tr>
<td>15. Sides, deep, lengthy, full; rib close and well sprung</td>
<td>6</td>
</tr>
<tr>
<td>16. Back, broad, straight, thickly and evenly fleshed</td>
<td>10</td>
</tr>
<tr>
<td>17. Loins, wide, thick, straight</td>
<td>8</td>
</tr>
<tr>
<td>18. Belly, straight, even</td>
<td>4</td>
</tr>
<tr>
<td>Hindquarters:</td>
<td></td>
</tr>
<tr>
<td>19. Hips, wide apart, smooth</td>
<td>2</td>
</tr>
<tr>
<td>20. Rump, long, wide, evenly fleshed, straight</td>
<td>2</td>
</tr>
<tr>
<td>21. Ham, heavily fleshed, plump, full, deep, wide</td>
<td>10</td>
</tr>
<tr>
<td>22. Thighs, fleshed close to hocks</td>
<td>2</td>
</tr>
<tr>
<td>23. Legs, straight, short, strong; bone clean; pasterns upright; feet medium size</td>
<td>2</td>
</tr>
<tr>
<td>Total:</td>
<td>100</td>
</tr>
</tbody>
</table>

There are a great many swine terms that need defining. A few of the important ones used in swine husbandry are given:

**Swine:** General name for any or all of the domesticated, omnivorous, suid mammals supposedly descended from the *Sus scrofa* or *indicus*, or infusion of the two, more specifically known as Duroc Jerseis, Poland Chinas, Chester Whites, Berkshires, etc., Hampshires, Tamworths, Yorkshires and other established breeds with their various cross-bred and mongrel breedings. Untamed wild animals are referred to preferably as &quot;Wild swine.&quot;

**Hog:** May be used synonymously with the term &quot;Swine&quot; but refers preferably to marketable animals.

**Gilt:** Young, immature, prospective swine mother.

**Sow:** Female swine after producing young.

**Boar:** Well-developed male swine suitable for breeding service.

**Boar Pig:** Young male swine under breeding age, usually under six months old.

**Stag:** Swine castrated (*"desexed"*) after the noticeable development of the secondary sexual characters such as tusks, shields, enlarged sheath, crest and others. Stags are docked 70 pounds on the large markets.

**Barrow:** Swine castrated before the sexual characters develop to a noticeable extent.

**Pig:** May be used synonymously with swine but preferably in America refers to those under three months of age. In England, Canada and Australia, pigs are swine of any age or weight.
Shote: Immature swine of either sex, except boar pigs, usually weighing from 60 to 175 pounds.

Weanling Pigs: Young pigs after weaning time.

Suckling Pigs: Young pigs following their mother and yet unweaned.

Pork: The dressed meat of swine used for food.

Management and Handling.—In the housing of swine to be paid to these essentials: Warmth, they do not thrive in real cold and freezing quarters; dryness, if kept in damp quarters contract various ills such as rheumatism and stiffness; abundance of diffused light; much direct sunlight, appropriately so for the new-born offspring to give them strength and stamina; shade, especially in the very hot months; ventilation, to insure fresh pure air; sanitation, to prevent diseases; safety; comfort; convenience, this being true not only for the swine but for the caretaker.

Swine should not be compelled to unnecessarily exert themselves, unless it be at certain time when particular advantages are to be gained thereby for the herdsman: serviceability to shelter advantageously, durability; reasonably low first cost; minimum cost of maintenance; and pleasing appearance so as to harmonize with the general surroundings adding by all means to the artistic and architectural beauty of the community.

In the feeding, the ration must be well balanced else the swine will not thrive. Corn alone in dry lot, even though plenty of water be supplied, together with salt, is deficient, in that it does not supply all of the nutritional factors necessary for the growth and well being of the pig. To illustrate, well-nourished swine eight months of age can be made to weigh 300 pounds, but they must have a balanced ration to do this,—such as corn, maize and milk (skim, butter or whole); or corn and alfalfa or clover or rape pasture together with a little meat meal; or corn and meat meal, both being fed in separate open containers, same being kept filled with feed and before the swine at all times. Corn fed pigs at eight months old fed by the Iowa Experiment Station weighed 57 pounds, and yet the first three months of this feeding time the pigs had a good ration. Similar pigs fed on corn and meat meal from the packing houses weighed 225 pounds. The corn pigs required 1,447 pounds of corn for 100 pounds of gain, but the ones receiving meat meal in addition needed only 366 pounds of corn plus 48 pounds of meat meal, a total of only 414 pounds of concentrated feed. Less than a third as much feed was required where the properly balanced ration was fed. It is wise and proper to vary the ration, giving equitable feeds in the right proportions and thereby giving the pig a chance to develop properly. Both the art and the practice of swine feeding are learned only by much experience mellowed with keen insight into the psychology and the nutrition of interesting but oftentimes perplexing animals.

The costs of production that enter into the making of marketable hogs center around these import items: Feed, such as the grains; pasture; equipment covering houses, troughs, fences and other details; man labor; horse labor; interest on the capital invested, an annual miscellaneous, or overhead, expense give a comprehensive idea as to the distribution of the total cost, or 100 per cent, among the mentioned items:

- Feed grains grown and purchased
- Pasture to supplement grains, also lot rent
- Man labor
- Interest on the investment or capital
- Horse labor
- Equipment upkeep
- Overhead expense

**Grand total expense**

The Swine Commission of the United Food Administration in the year 1917 that it took the equivalent value of 12 hogs to produce one hundred pounds of pork, which is market the average hundred pounds of marketable hog delivered to the Chicago, the general market hog market of the world. This counts the costs of all teritory and only keeps of the herd. Defend therefore, this means that if number two hogs is worth a dollar a bushel of that the farmer who ships to the mark the cost not on the average make any money. He gets over $12 a hundred pounds for the hogs. The good farmer will of course put them more cheaply, but when the costs put down to the 12 bushel basis that is good indeed. Of course the man who bungles the garbage, the kitchen waste from the city towns, can produce hogs more cheaply than the man who feeds high-priced grains. He can start his pigs from six to nine pounds of garbage to produce as much pork as a pound of mixes agent grains.

The best forage crops and pastures for are alfalfa, red clover, dwarf essex rape, grass, rye, wheat, soy beans, cow peas, sweet clover. All of the clovers are esp. good.

The best grains are Indian corn, barley, wheat, sorghum seed, kaifir corn, milo oats, peanuts, soy beans, cow peas, and oats similar nature.

The best balancers of the ordinary are the milks, meat meal, packing house age, linseed oil meal, wheat middlings, corn meal, blood meal, peanut meal, bean meal, gluten feed, together with the preferably leguminous and tender pastures.

To secure the greatest success in the feeding and management and marketing of swine must look to these essentials:

First.—Locate the business where the hogs are favorable to pork production usually being where there is an abundant cheap grains and other feeds suitable for and where the markets are relatively good and easily accessible. Go to those sections hogs are making their owners money.

Second.—Select good, sound, healthy, foundation stock of the right market as the right right hogs type.

Third.—Have an ideal and work toward in your feeding and breeding operations.

Fourth.—Feed a properly balanced
one that will supply the essential nutrients at the right time.

Fifth.—House the animals in sanitary, well-lighted, comfortable convenient quarters.

Sixth.—Keep the animals healthy by sensible methods, use preventive measures to avoid cholera, the scourge of swine husbandry, this being done by immunization, using the anti-hog cholera serum perfected by the government, and purchaseable most everywhere.

Seventh.—Be a good manager, keeping everything and everybody lined up so that the whole scheme harmoniously works to a common ideal of doing the right thing, in the right way, at the right time. There are many corners to watch, as in all good businesses, hence the vigilant watchful spirit is to be as industriously cultivated.

Eighth.—To be most successful in the swine business one must like it, put his heart into it, yes, and live with it.

JOHN M. EVARD,
Professor of Animal Husbandry, Iowa State College.

SWINTON, William. American educator: b. Salton, Scotland, 23 April 1833; d. New York, 25 Oct. 1892. He came to Canada in 1843, where he studied at Toronto and then to the United States, where he continued his studies at Amherst College. He subsequently taught at Greensboro N. C., and in New York and during the Civil War was war correspondent of the New York Times. From 1869 to 1872 he was professor of English language and literature in the University of California. His writings include: 'Rambles Among Words'; 'Twelve Decisive Battles of the War'; 'Campaigns of the Army of the Potomac'; 'Word Analysis'; 'Studies in English literature,' and 'Outlines of the World's History.'

SWISS FAMILY ROBINSON, The, a famous romance by J. R. Wyss, which was begun by his father and published as 'Der Schweizerische Robinson.' It was translated into French and afterward into English. It is an entertaining tale written for young people, after the style of 'Robinson Crusoe,' from which the author is supposed to have derived many of his ideas, and has been cleverly parodied by Owen Wister in 'The New Swiss Family Robinson' (1882).

SWISS GUARDS. Swiss companies served in France from the time of Louis XI, who paid particular attention to cultivate the friendship of the cantons. In 1571 Charles IX created the charge of Colonel-General of the Swiss at Montmorency, who commanded all the Swiss in the kingdom, except the 100 guards of the king. The institution of the Swiss guards as a complete regiment dates from 1616. In 1714 it was composed of 12 companies, some of which had two captains. Louis XIV gave it five officers to each company. All the officers and men were Swiss, and the companies mounted guard before the king according to the rank of the cantons to which their captains belonged. The Swiss guards followed in order of precedence after the French guards. They enjoyed liberty of worship. According to the arrangement with the Cantons, the Swiss guards could not be obliged to serve against Germany beyond the Rhine, against Italy beyond the Alps, or against Spain beyond the
Pyrenees. This convention was often broken. The attachment of the Swiss guards to the king made them obnoxious to the people during the Revolution. They were repeatedly banished and recalled, and on and after 10 Aug. 1792, when they were delivered to the mob against the mob, they were massacred without mercy. The Lion of Lucerne was designed by Thorwaldsen in memory of their heroism. At the Restoration, a Swiss Guard was formed to guard the person of the worthless Bourbon, but it was dispersed by the Revolution of 1830. The Vatican Palace, Rome, the residence of the popes, is guarded by a company of Swiss, who are termed the Swiss Guard. Consult Stephens, H. M. 'History of the French Revolution' (2 vols., New York 1891) and Ternaux, 'Histoire de la Terreur' (8 vols., Paris 1863-81).

**SWISS LAKE DWELLINGS.** See Lake Dwellings.

**SWISSHELM.** Jane Grey, American reformer and author: b. Pittsburgh, Pa., 6 Sept. 1815; d. Swissdale, Pa., 22 July 1884. She was an ardent abolitionist; an ardently ardent advocate of negro rights; an angry, hot-blooded, burning opponent of slavery; and while editing the Saint Cloud (Minn.) Visitor had her office and press destroyed by a mob for advocating abolitionism. She was among the first to become a nurse in the Union army. Besides voluminous contributions to current periodicals, she published 'Letters to Country Girls' (1853), and an autobiography 'Half a Century' (1881).

**SWITCH GRASS.** See Grasses in the United States.

**SWITCHBACK.** An inclined railway in which the progress of the train or car on the descending route is effected partly or wholly by gravity, the car first running down a steep incline and by its momentum surmounting a lesser incline, alternate ascents and descents continuing to the end of the course. Switchback railways are constructed also by curving a track alternately backward and forward along the side of a hill thus obtaining practicable grades for descent. The switchback method is popularized in the circular switchback railways, a common feature of American resorts. The Mauch Chunk Switchback in Pennsylvania is one of the best known of these gravity railways. It was formally used to carry the coal from the anthracite mines to the valley; the coal is now transported through a tunnel, and the switchback is reserved for the amusement of visitors. See Railways, ELEVATED.

**SWITCHBOARD.** See Electrical Terms.

**SWITCHMEN'S UNION OF NORTH AMERICA.** See Railway Labor Organizations, Railroad Organizations.

**SWITHIN, or WITHERUN, Saint.** Bishop of Winchester (died 832). He was tutor to King Egbert's son Ethelfluid, a zealous builder of churches, and of conspicuous devotion. He is credited with many miracles and when he died asked to be buried where "passers-by might tread on his grave and where the rain from the caves might fall upon it." When a century later his body was to be exhumed for the purpose of being deposited in the Cathedral, on the day appointed for the translation (15 July) it rained a full 40 days after so as to delay the ceremony, it was believed, originated the popular belief that if it rain on Saint Swithin's day wet weather 40 days after it.

**SWITZERLAND.** Fr. La Suisse; Ger. Die Schweiz; L. Ital. Il Sottc. An ancient federal republic of Central Europe, extending between 45° 49' 2" and 47° 30' 26" N. latitude and 5° 7' 26" and 10° 29' longitude. The superficial area is 15,983 square miles; greatest breadth, 226 miles; greatest breadth, 136 miles. The country is a confederation of 19 whole cantons, the whole divided into ministrative districts. It is bounded north by Baden, with the Rhine as its northeastern boundary; Bavaria and Württemberg to the northeast; Switzerland to the southeast by Liechtenstein and the Tyrol. The Rhine and the Grison Alps intervene between it and Geneva, natural boundaries, and the area is northwestern by France, where the Alps and the Rhine form natural boundaries; and the valley of the Rhine and the River Doubs form the demarcation. The following table shows the cantons, their areas and population, areas in which they joined the confederate

<table>
<thead>
<tr>
<th>CANTONS</th>
<th>Area in sq. miles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zürich</td>
<td>666</td>
</tr>
<tr>
<td>Berno</td>
<td>2,959</td>
</tr>
<tr>
<td>Lucerne</td>
<td>379</td>
</tr>
<tr>
<td>Uri</td>
<td>461</td>
</tr>
<tr>
<td>Schwyz</td>
<td>381</td>
</tr>
<tr>
<td>Obwalden</td>
<td>183</td>
</tr>
<tr>
<td>Nidwalden</td>
<td>104</td>
</tr>
<tr>
<td>Glarus</td>
<td>268</td>
</tr>
<tr>
<td>Zug</td>
<td>252</td>
</tr>
<tr>
<td>Fribourg</td>
<td>438</td>
</tr>
<tr>
<td>Solothurn</td>
<td>1,063</td>
</tr>
<tr>
<td>Basel-Stadt</td>
<td>123</td>
</tr>
<tr>
<td>Basel-Land</td>
<td>163</td>
</tr>
<tr>
<td>Schaffhausen</td>
<td>113</td>
</tr>
<tr>
<td>Appenzell Ausserrhoden</td>
<td>933</td>
</tr>
<tr>
<td>Appenzell Innerrhoden</td>
<td>68</td>
</tr>
<tr>
<td>Saint Gall</td>
<td>1,083</td>
</tr>
<tr>
<td>Grisons</td>
<td>754</td>
</tr>
<tr>
<td>Aargau</td>
<td>542</td>
</tr>
<tr>
<td>Thurgau</td>
<td>1,083</td>
</tr>
<tr>
<td>Ticino</td>
<td>1,088</td>
</tr>
<tr>
<td>Vaud</td>
<td>1,248</td>
</tr>
<tr>
<td>Valais</td>
<td>2,036</td>
</tr>
<tr>
<td>Neuchâtel</td>
<td>312</td>
</tr>
<tr>
<td>Geneva</td>
<td>1,077</td>
</tr>
</tbody>
</table>

Total: 15,983

Nearly all the cantons have all names in French and German. Thus, in Luzern in German, while Obwalden are known as walden-le-Haut and Unterwalden-le-Inférieur. Zug has a French equivalent Solothurn in Solothurn; Grischaubünden in German; Neuchâtel in Neuchâtel; Ticino, Tessin; Vaud and Waadt, and Wallis, and Geneva, Genf.

**Topography.** Embracing the highest mountainous land in the Central Alps, Switzerland has been aptly styled the Switzerland of Europe. Its frontiers are mainly composed of mountains, rivers as

Those great mountain ranges and the
of easily-blocked tunnels by which it is possible for troops to cross them; said to make the country absolutely impenetrable in the hands of a determined garri-son. During the European War, Switzerland was a solid rock in the midst of a turbulent sea of nations at war on all the four fronts. That "fortress" was the strategic point of the mid-European battle-ground; its rear would have had an enormous military value for any one of the belligerent nations. These lofty ranges there are gigantic, magnificent lakes and wild, romantic.

Though Switzerland contains the ranges of the Alps and the greater part of the Jura chain, the highest peaks of the Alps belong to France. Physically the Jura falls into four natural divisions, the Alps, the Outer Alps (Voralpen), the Bernese Oberland, and the Bernese Oberland, and the Rhone valley. Other passes connect Switzerland with Italy; the most important being that of the Great St. Bernard in the Pennine Chain, that of the Simplon in the Lepontine Alps, the Saint Gotthard (q.v.) at the head of the valleys of Reuss and Ticino, and those of the Bernina, Splügen, of the Grisons southward. Altogether about 40 commercial highways pierce the Alps, besides a larger number of natural passes unprovided with roads. Of the great pass-roads connecting Italy through Switzerland with southern Germany the most important in Roman times and in the Middle Ages was the Septimer Pass (7,580 feet), connecting the head of the Val Bregaglia with the Rhine valley above Chur by way of the Oberthal and the Rhone. The Saint Gotthard was not known to the Romans, but was frequented by pilgrims in the 13th century. The Simplon pass (6,600 feet) was a paved Roman road; the railway tunnel which runs under it was opened in 1906. The Great Saint Bernard pass (8,110 feet) connecting Switzerland with Italy starts on the Swiss side at Martigny in the valley of the Durance, and ends at Aosta in the Dora Baltea valley.

The famous hospice of Saint Bernard is mentioned in documents of the 10th century. The avalanches of Switzerland are famous for their destructive propensity, but on their record, year by year, they do not cause any appalling loss of life or property. The mighty forces of nature, in storms at sea, inundations and cyclones, cause probably a much greater proportionate loss of life and property than do avalanches. Though they fall all the year round in Switzerland, spring is the great time for avalanches. During that period some of them descend with remarkable regularity in particular places and at recognized spots. The snow piled up during the winter on the grass slopes below the (summer) snow-line, gradually loses its cohesion as the spring melting advances and glides down to its appointed place according to the trend of the ground. In places where huge masses of snow are collected above steep declivities terminating in narrow outlets the avalanches descend with terrific roar and pressure against the lines of defence — the forests. For this reason the forest laws of Switzerland are very strict. Everything is done to preserve the natural rampart afforded by a mass of pines, and no one is allowed to fell a tree on his own ground with government consent. Where avalanches fall regularly every year, stone galleries are built or tunnels are mined out of the solid rock to protect roads. Many protective devices are em-ployed to arrest the torrents of ice, snow and slush so that the danger from them has largely diminished. The Co-operative or Dust-Snow avalanche is the most dangerous on account of its suddenness, and the most difficult to provide against. This is a collection of loose, freshly-fallen snow which has been caught up in one of those sectional tornadoes that spring up on the mountain slopes, and is
driven down on the wings of the wind to the valley below. The Schlag-Lawine or Stroke-Avalanche is the usual spring variety, which pours down the slopes like a swiftly-flowing river. This is the type that can be more successfully regulated. It has a secondary form in the Grand-Lawine or ground avalanche, which carries earth and rubbish with it and performs a beneficial task in bringing down soil from the heights to the plains. Whereas the avalanche is snow in quick movement toward the valleys, the glacier is snow (pressed into ice) in slow movement. See Glacial Period; Glacier.

Rivers and Lakes.—Owing to its mountainous nature Switzerland is naturally a land belonging to many river systems, though none of the rivers acquires such a size within its limits as to become of much navigable importance. Its position as the centre of the principal watersheds of Europe has been referred to. Great rivers take their origin in Switzerland and their main stream of development in other countries. Both the Rhine and the Rhone rise here, as well as the Po and the Danube. The first three spring from the Saint Gotthard mountain mass, but the Rhine is formed by the junction of three distinct head-streams, the Vorder, Mittel and Hinter-Rhine. It flows north into the Lake of Constance, and thence west to Schaffhausen, where it forms the celebrated falls of that name, the largest in Europe in volume. It is navigable for vessels at Core in the canton of Grisons, for vessels of 150 tons, but its navigation properly begins below the falls. Its principal affluent in Switzerland is the Aar, which, after traversing the Lakes of Brienz and Thun, winds across the Swiss plateau to join the main stream about midway between Lake Constance and Basel. The Rhone, said to be the most rapid of the larger rivers of the world, rises in the Rhone glacier (Valais), flows northwest in the Lake of Geneva, issues thence at the town of Geneva under the name of the Arve', and quits Swiss territory about 10 miles below. The waters which the Po receives from Switzerland are carried to it by the Ticino, and thereby to the eastern bay of the Mediterranean, just where the Danube receives are carried to it by the Inn and then thence to the Black Sea. The lakes and mountains form a more important hydrographical feature than the rivers. The former are remarkable for their number, size, depth and the grandeur of their scenery. The largest lake, that of Geneva (also known as Lake Leman), has an area of about 220 square miles; Lake Constance, in the northeast, has 208 square miles. Both of these, as well as Maggiore on the south side of the Alps, belong partly to other countries; but within the limits of Switzerland, and not far from its centre, are Lake Neuchâtel (93 square miles), with Morat and Bienna in its vicinity. Thun with its feeder Brienz, Lucerne or Vierwaldstättersee, Sempach, Baldegg, Zug, Zürich and Wallenstättere. All these internal lakes belong to the basin of the Rhone. The greatest depth of Lake Geneva is 1,015 feet, placing the bottom at about 200 feet above sealevel, the bottoms of the lakes on the southern side of the Alps are below the level of the sea. Rapid mountain torrents feed nearly all the Swiss lakes, entering their upper end charged with sediment, which is deposited on the lower end. Thus filter and regulate the rivers, thereby reducing to a low flow the lower valleys of the country, floods. The Aar flows from its banks, but this has been remedied by the construction of a canal to divert the lake of Bienna, by which the low tide of the stream is regulated.

GEOLOGY AND MINERALS.—The most notable feature in the complicated structure of Switzerland is the extent to which the Alp range has been folded, contorted and uplifted by the tremendous forces that have led to the formation of these mountains. A typical example is presented by the Saint Gothard, where the core of the range has been uplifted and the strata on each side of it have been forced up so that the slope is almost perpendicular. At the summit, the appearance of the ribs of a fan radiating from a single point. All the loftiest Alp peaks have a nucleus of granite, on which mica-slate reclines generally at a high altitude. On the north side, the Jura give way to the Jurassic rocks of which they consist; the mountains on the east are formed of gneiss and mica-schist with slates in places, especially in the Grisons. The slate rock is found in the North Germanic region, stretching from the northeast of the Geneva and the lakes, may be described as an area of principally Miocene deposits. This two mountain regions composed chiefly of more ancient date. Switzerland is known for its mineral springs. Thermal and mineral waters are dotted all over the country. Baden, the chief of the bath centres, enjoys the popular climate and its hot springs have been celebrated since Roman times. The health resorts are those of in Aargau, Pfeffers in Saint Gall, Louéche and Saxon in Valais, Saint-Blanien, Weissenburg and others of Berne; Weissbad near Appenzell, in Glarus, Seewen in Schwy. Andermatt in Unterwalden, and many others are on 400 health resorts in Switzerland, many containing luxurious Kurhäuser, hotels, clubs and other numerous attractions for devotees of sports and tennis lawns. Native initiatives have so successfully exploited the gifts of nature that Switzerland has been called the "playground of Europe."—if not of the world.

CLIMATE.—The climate of the Alps is characterized by the altitude and the easterly winds, which bring moisture in the form of snow to the southern side of the range. The known wind is the Föhn, a dry northeasterly wind that blows with great velocity.
d and the upper valleys of the Rhine, some
and Linth, and is, from
by heavy rain. On its approach
erises and the barometer falls
recently a fierce storm breaks out.
Is calculated to blow for 17 days in
2 days in summer and 16 days in
the cold north-northeast wind, known
high
in the direction between the Bernese Oberland
and the interior of Ticino, is noticeable in sum-
lar winds prevail at the higher levels
of great importance to invalids, e.g.,
ning wind, blowing down-hill,
interaction with the evening wind,
low.
The higher inhabited regions
land may be divided into three zones.

The hill region, between
of 1,300 and 2,600 feet above sea
water in the lakes in northern
Switzerland and the adjacent
The slopes. Great heat often prevails
summer, though a pleasant relief is
by the lake baths. Lake Constance
rest of the inland waters, with a
at of 68° to 75° F. The second, or
region, extends from 2,600 to 3,900
of numerous towns and villages.
Alpine region (3,900 to 6,550
sents a much lower temperature and
weather suitable for certain classes
suffering from lung disease. At
in the upper part of the Engadine
mean January temperature is 17.5°
July, 53°, and the mean of the whole
in the general the valleys have a severer
mountain peaks of equal elevation,
and, therefore, heavier air steadily
in to the bottom of the hollows. At
of the Alps, such as Zürich and
normal winter temperature is about
summer temperature from 30°
towards; at Geneva the corresponding
are as high as 33° and 66°. Some
lying valleys, especially those that
the east and closed to the west, are
said to have nine months' winter and
the conditions.

Fauna.—The differences of elec-
ally the climate and the natural
is of the soil, hence few countries in
of larger extent, can boast of a
d vegetation than Switzerland. The
Alps is one of peculiar interest.
Alp ranges the Alps harbor
able number of plants found nowhere
of those which are found elsewhere
ity do not reappear in the plains and
ow, but in distant mountains on
ations. Out of upwards of 800
species to the Alps, but not to the adjoin-
s, nearly one-fourth are absolutely
these mountains, and nearly a fifth
also in the Arctic regions, these
are hence known as Arctic-Alpine
as the elevation ascends there is a
range in the aspect of the vegetation,
been divided into seven regions.
In
adjacent countries, Switzerland
in increasing the atmospheric moist-
the valleys at the base of the moun-
tains chestnut and walnut grow freely even
on the north side, while in the valleys
opening toward the Mediterranean lies a zone occupied
by these trees while still at a considerable elevation.
Higher up is the zone of the beech,
maple and other ordinary foliage trees reaching
about 4,000 feet, and then the zone of
fruits and pines rising above 4,000 feet higher.
This region is followed by one of Alpine
shrubs, among which rhododendron, (Alpine
roses), heaths and whortleberries are conspicuous,
along with larches and two species of pine,
the dwarf-pine and the cembra-pine, remarkable
for its edible seeds and peculiar to this zone.
The shrubs cease to grow at about
height of 7,000 feet, but the Alpine plants that
cover the pastures intermingled with the shrubs
ascend to the snow line, and even beyond in
places too steep for snow to lie. Heer collected
about 100 different species of flowering plants
above the snow limits on the Alps and lower regions
Grisons at about 8,500 feet; 24 species have been
observed on the Grisons Mules on Mont
Blanc at a height of from 9,800 to 10,600 feet;
and the sides of the Pizzo Centrale on the Saint
Gothard have been known in August to emit
for a considerable distance the fragrance of
the flowers which covered them in patches. The
celebrated edelweiss, which all Alpine tourists
celerately collect, is the most retiring of these
snow region plants. Of utility plants the
characteristic product of the plain and lower regions
is the vine, which grows up to about 1,800 feet
above sea-level. The hilly or lower mountain
region up to 4,000 feet produces good crops of
barley and oats and excellent pastures. Above
this, in the Sub-Alpine region, up to 5,500 feet,
no regular crops are grown; in the upper
Alpine region the vegetation becomes more
stunted and the variation of the seasons is lost.
Beyond lies perpetual snow. Many plants even
of the lower parts of the country are stony and
sterile, but no spot that can be turned to good
account is left unoccupied. Though chiefly an
agricultural country, Switzerland cannot grow
enough crops to support its population, so that
the majority of the foodstuffs have to be im-
ported. The productive land is divided among
some 300,000 peasant proprietors who raise,
besides the crops already mentioned, wheat, spelt,
rye, potatoes and tobacco, and manufacture
cheese, condensed milk and wine. Nearly 30
per cent of the entire area is unproductive and
about 30 per cent is under grass and meadows.
Considerable quantities of fruit are grown.
Among domestic animals the first place belongs
to the horned cattle. At the last census there
were in the country 130,613 horses, 1,615,645
cattle, 171,635 sheep, 850,000 pigs and 358,000
goats. In the summer the cattle are fed on
the numerous mountain pastures or 'alps,' but
of their winter fodder a large proportion has
to be imported. In several cantons bee-keeping
and silkworm culture are carried on.
Among the wild animals are bears, wolves,
chamois, goats, boars, stags, badgers, foxes,
hares, otters, squirrels; birds of prey of large
dimensions; the snipe, heathcock, cuckoo, black-
and woodpecker. The lakes and rivers
produce a varied abundance of fish.

People.—The Swiss are a mixed people as
to race and language. The bulk of the popula-
tion is of Teutonic race, but the Latin race
(partly French, partly Italian) compose nearly three-sevenths of the whole. The Swiss Teutons belong to the Alemannic stock and still speak a distinctive Alsatian dialect usually called the Swiss German or simply Swiss. They occupy the whole of the upper Rhine valley, as far as its extreme western angle at Basel, consequently the whole of the Helvetian highlands lying north of the Central Alps, besides the upper Rhone valley down to Sion or Sitten, under the Bernese Alps. The rest of the upper Rhone valley and the western slopes of the Jura are French, comprising the cantons of Valais, Vaud, Geneva, and Neuchâtel. The Italian portion is made up of those parts which belong to the basin of the Po—the whole of the canton of Ticino and the valley of Poschiavo in the Grisons. Along the head streams of the Rhine, in the valleys of the Grisons, and in the region between these rivers and the banks of the upper Inn, and even still farther eastwards, in some Tyrolean valleys beyond the Swiss frontier, are scattered the Rumonsh-speaking people, whose language at first sight seems like a dilemma of connecting link between German and Italian. These are the interesting Rhaeto-Romance tribes, which had long failed to receive the attention of the scientific world. Critical research has since established that Rumonsh is an entirely independent Neo-Latin tongue, standing on the same level as Spanish, Portuguese, Italian, Langue d’ Oc, Moldow-Wallachian (Rumanian), and Langue d’Oil. Rumonsh has two main dialects—the Overland dialect or Rumonsh proper, divided into two sub-dialects, the Sur-Selvian and Sub-Selvian, and the Engadine or Ladin dialect (see RÌÉTÌÀ). Yielding to the pressure of the vigorous Teutonic tribes, the Rhaeto-Romance races became at last confined to the solitary upland valleys, where they still continue to eke out a laborious existence. Their speech is also steadily yielding to encroachments and is gradually being supplanted, either by German or Italian. As the Swiss races differ in origin and language, so also do their temperamental characteristics. The French Swiss is active, vivacious; the Italian Swiss, fiery and irritable; the German Swiss, calm and thoughtful. Yet with all their racial and spiritual divergences, a fervent patriotism is common to all of the Swiss people. Independence and liberty are the keynotes of their existence. There is no desire among the German, French or Italian Swiss to be united with their neighbors of corresponding nationalities. It has been said that the Swiss as a people often suffer in the judgment of tourists by failure to live up to their reputation as a “mountain people” to a glorious “Alpine” character. In truth, however, the idea that dwelling in a mountain region has an ennobling influence on the human character is mostly fallacious. The Swiss are expected by the traveler to carry themselves in all things with the pride and dignity of people who are born and bred in the original home of European liberty. But civilizations and traditions of human freedom have always begun on the plains—by seashore and river bank. If all things denote the pride and dignity of people who are born and bred in the original home of European liberty, it is rather a handicap than an advantage to a race to inhabit a mountain country, for in the earlier stages of civilization the mountain fastnesses have imposed upon them the duty of shielding patriots and criminal fugitives from justice. In later stages, again, men who have achieved the machinery of civilization. It has been facetiously pointed out that mountain air sharpens the wit of the Swiss more than the wits, and there are diseases attacking particularly the brain which are almost peculiar to mountain districts. One favorable national circumstance of the Swiss is that their central position in respect to the great plains of Europe has put them in a position of a connecting link between the chief currents of civilization. What they have achieved in spite of the cap of their mountains is one of the marvels of the human race. To these natural barriers they owe in the main their sense of national unity. **Industries; Chief Towns.**—The Swiss depend for their support on various branches of industry, to which much attention has given of late years. There are now large and cotton factories, while the watch and clock industry established in Geneva since the 16th century has been long famous. Industries are: Embroidery; Besançon; chocolate (Suchard, Cailler, etc.), straw plaiting, wood carving, aniline dyes and aluminum. Asphalt is worked at Solothurn, and English company at Val de Travers and Château-Land. In the lowlands the chief occupations are agriculture, horticulture and wine growing. In the highlands almost the sole industry is rearing of livestock. The principal imports are cereals, fruits, vegetables, colonial produce, food substances, iron and mineral products. Being an inland country, Switzerland has commercial intercourse only with the surrounding states; but the trade with other countries, especially Great Britain and the United States, is very important. A source of enormous revenue is the catering for the thousands of tourists who invade the country. Switzerland is for its hotels, and it is no exaggeration to say that the Swiss are the most expert art of hotel-keeping. The large modern establishments at Geneva, Vevey, Zürich, Lucerne, Interlaken, etc., are models of the modern hotel; the smaller hotels are often equally conducted, and indeed a really bad inn is met with in French or German Switzerland. Normal times the prices are moderate. A flourishing occupation is the professional guide, who is indispensable for expeditions among the higher mountains, especially on those which involve the passage of glaciers. As a class, these guides are well treated and respectable men, well versed in antiquities and thoroughly acquainted with the laws and resources of the country. The mountain of the Swiss is strongly affected by the life of the tourist. The inhabitants generally well educated and proficient in languages. Offering asylum as it does to social rebels of all countries, Switzerland is a kind of international clearing house for thought and theory. For many years it has been the free and open laboratory in which the schemes of anarchists, Bolsheviks, Nihilists, free Masons, etc., have long been hatched. During the European War the Swiss were the mecca of diplomats, consuls and high-born refugees. The Gallic, th
1 Mt. Blanc

2 St. Gotthard Pass and Bridge
1 The Matterhorn and Riffelsee
2 Lake Lucerne (Vierwaldstattersee)
the Slav new thought of the day are
stood and discussed in Switzerland, wiss book stores are the most cosmo-
d representative in the world. There
up to a considerable time is devoted to the Zionism
Geneva, Bern (the federal capital),
Saint Gallen, Chaux-de-Ponds, Lu-
1 Winterthur and Neuchâtel. Geneva,
of the Red Cross, was designated the
t the Peace negotiations by the Allied
conferences of 1919.
unifications.— The state railroads of
and have a length of 3,670 miles, while
32 miles of foreign railways within
deration. Owing to the heavy capital
$465,000,000) the state railways do not
rot. In the last normal year (1913)
ed 91,546,639 passengers. The cars on
the lines follow the American plan.
eterways and lakes 22 companies oper-
erans and barges. The organization
at office is highly efficient. Tourists' to be
may be transported very cheaply by
st; delivery is prompt and reliable.
over 2,000 miles of 2,153 freight
lines and 2,390 telegraph offices.
there are constructed new funicular
and tramways leading up the moun-
t; these produce a good profit— over
st, and are usually privately owned.
1918, the Swiss National Council
project of Federal subvention of a
he Rhine at Basel, which will open
commercial traffic between Ger-
Switzerland. To counteract the pos-
f drawing on e republic within the
German economic influence, an alter-
as proposed, by which Switzerland
placed into direct communication with
erranean via the Rhone. This river
made navigable for the 20 miles be-
nea and Lyons by the construction of
Genissiat, just below Geneva. By
Switzerland could obtain all the
ecessary for its existence. In April
was announced that Switzerland had ac-
vess, of 105,000 tons total tonnage,
ched to the port of Cotte on the
ast (Gulf of Lyons), with which a
will connect with the Swiss rail-
section of a central warehouse
at the Etang de Thau.
and Education.— There is com-
gious liberty in Switzerland. Accord-
last census there were 2,107,814 Prot-
593,538 Roman Catholics and 18,465
order of the Jesuits is not allowed
confederation. In 12 of the can-
Protestants form the majority; the
in 10. The latter have the larger
f clerics, some 6,000, under nve bish-
hildren, and the official language is

greer which he does not adhere to.
ition of religious orders or new con-
prohibited.
swiss educational system is both gen-
practical (also for the six-
mentary school classes are mixed and contain
up to 45 children. The curriculum assures to
boys and girls a general elementary education
cluding a knowledge of French, while con-
instruction is given in music, physi-
carpentry, needlework and cookery. After
a four years' course the scholars enter the sec-
ondary schools, where they remain till 15.
A five years' advanced course in the sec-
ondary school the scholar has the option of
ultimately entering the gymnasium or the in-
dustrial and commercial schools. Up to the
age of 15 instruction is free; after that the an-
ual fees amount to 60 francs ($12). There
are great universities in the chief cities, which
are much frequented by foreign pupils. The
Swiss technical schools are second to none
in the world; they teach everything from waiting
at table to watch-making and science. In
mountain villages the schools are kept open
only during the long Alpine winter. All
through the summer the boys work in the fields,
while the masters and teachers attend to their
own farms. From the primary schools to the
higher the level of instruction is higher.
In the 4,690 primary schools there are about
350,000 pupils annually under 12,023
teachers. The cost of these institutions is lit-
tle over $10,000,000 a year. In the 642 higher
schools there are about 35,000 pupils annually
under 2,000 teachers. The cost of these is
about $1,500,000 a year. Besides these there
are schools of agriculture, dairying, commerce,
etc., while continuation commercial schools
give further instruction to some 10,000 pupils
yearly, who attend vacation and summer classes.
In the seven universities, Basel, Zürich, Bern,
Geneva, Lausanne, Fribourg and Neuchâtel,
there is an average of 9,000 students a year, of
whom fully a third are foreigners. An aver-
ge of 15,000 children a year are treated in the
rectorial schools, and some 1,300 in 28
schools for the feeble-minded. There are 14
special schools for deaf-mutes, with an average
of 700 pupils a year. Special attention is paid
in all Swiss educational institutions to gyn-
nastics and physical culture.

Government.—As already stated, Switzer-
land is a confederation of 19 entire and six
half cantons, which have been united for fed-
eral purposes since 1848. The present constit-
ution, which dates from 29 May 1874, vests su-
preme legislative and executive authority in two
chambers—(1) a State Council (Ständerath)
of 44 members, chosen two for each canton and
one for each half-canton for three years; and
(2) a National Council (Nationalrat) of 167
delegates of the Swiss people, chosen also for
three years by direct manhood suffrage, one
deputy for every 20,000 of the population.
Among the various forms of government de-
developed in Europe that of the Swiss federal republic has
been achieved by Switzerland alone. That
country may claim to possess the only truly
democratic government in the world.
The Swiss have produced great results with small
resources; they have shown that the plain
man can do in the way of government without
the help of a ruling class, of gentlemen of lei-
ure, of millionaires or of professional politi-
cians. An ideal democratic constitution should
make it impossible for political representatives
to impose on the country laws which the people
do not want. It should also be difficult, if not
impossible, for a small majority to impose constitutional changes to which nearly one-half of the electors are opposed. Yet these obvious requirements are conspicuously absent in democratic countries, for it is often uncertain how far laws, which are easily carried through a parliament or congress, are really wanted by the people, and whether, if put to the popular vote, they would have even a bare majority in the face of the opposition. The people as an aim of government is altogether lost sight of and party necessities become the sole motives of political action. Another requirement of democratic government is that the political machine should work as smoothly as possible, and for this end care should be taken so as to constitute the legislative and executive bodies as to avoid as far as possible the political crises consequent upon sudden changes of government and to minimize the turmoil or excitement produced by elections. The Swiss have solved these difficult problems with ingenuity and originality; they have evolved a political machine in which the frank and sure expression of the popular will and the smooth working and stability of government are obtained to far greater extent than in any other country.

Though the cantons are united together as a confederation or "Eidgenossenschaft" for mutual defense, each retains its individual independence and governs itself according to the constitution best suited to its own requirements. In these various constitutions there are gradations from the fullest democracy to the purest representative forms; but pure non-representative democracies have been adopted in the smaller cantons only, such forms of government being in fact impracticable except among small populations. The United Chambers, or as they are called, the Federal Assembly, to which is confined the supreme government. The executive authority is deputed to a Federal Council (Bundesrat) of seven members, elected for three years by the Assembly, the president and vice-president of which are elected annually, and are the first magistrates of the republic. The Council sits at Bern, which is the headquarters of the federal administration. Though ranking only fourth in point of population, Bern owes its status as capital (since 1848) partly to its central position in the Swiss Suhleland and partly to the historical importance of the canton, which is itself a result of that position. The principles of the referendum and of the initiative are in force. By former, if a petition is presented by 30,000 citizens for the alteration or revocation of a measure passed by the legislature, or eight cantons demand it, the law in question must be referred to the direct vote of the nation. The latter signifies the right of any citizen to demand a direct popular vote on any constitutional question. The federal government alone can contract treaties or declare war; it also controls the army, postal system, finance and customs. The cantonal authorities have jurisdiction over civil and criminal law, justice, police, public works and schools. The president is elected annually and receives a salary of $2,700; he is usually succeeded by the vice-president, whose salary is $2,000. A pension is paid to the other five members of the Bundesrat. These seven officials act as ministers: (1) Foreign Affairs; (2) Interior; (3) Justice; (4) Militia Finance; (5) Agriculture and Industry; (6) Posts and Railroads. The 44 member State Council receive about four dollars a day of attendance and an allowance for traveling expenses. Clergymen are not eligible to vote, but every citizen over 21 has the vote and is allowed to vote by direct vote. Out of 839,114 eligible, 1912, no fewer than 529,000 recorded their votes in a referendum held that year on insurance law against sickness and accident. Under the operation of the federal system, the Swiss, like the British, have a Cabinet, but unlike the American, has the right to be informed of legislation; but if a measure introduced having its support, is rejected by the Assembly in the order of their seniority on the agenda, the cabinet can veto it. Swiss elections are held every four years, and the number of Swiss presidents is fixed by law.
cantsons there is no special administrative machinery; all the male citizens assemble open air at stated periods and transact public business. These assembles are Landesgemeinde. The administrations in the larger cantons are carried on by regularly elected representatives; in most of the referendum exists, while some have a popular initiative.

Official System.—The Federal Tribunal or Gericht is stationed in Lausanne and is elected by 24 members, with nine supply judges appointed by the Federal Assembly. Their term is six years, and they may be elected. The president and vice-president hold office for two years and are not for re-election to those posts. The salary paid is $3,200 annually; the others, divided into three divisions, the trias final jurisdiction in all national suits; suits in cases where the value is in dispute not less than $600, and in appeal cases of $1,000. Civil suits are such in which constitutional divestive matters are concerned, internal disputes, or appeal against the decision of federal authorities. It tries treasons against the constitution, rebellion, and treason by various ways. The salary is $2,000 annually, and the president is paid two dollars.

For ordinary civil and criminal cases, there is an additional judge who has its own judicial system. Captivity was abolished in Switzerland by the constitution of 1874, but since 1879, there have been no reintroduced the death penalty, which now exists in the 10 cantons of the Inner-Rhoden, Fribourg, Lucerne, Glarus, Schaffhausen, Schwyz, Saint Gall, Wallis, and Zug. Nevertheless, capital punishment is not referred to in the Swiss code.

Switzerland derives its revenue from the alcohol monopoly, customs, railways, telegraphs, state property and investment in medicinal service, exemption taxes, revenue gathered for federal purposes, and so on. The revenue, normally, to about $32,500,000, about from the customs and almost the rest the public services. The production and sale of alcohol is a federal monopoly and produces about $1,000,000 annually. The proceeds of the latter are divided among the cantons, governments, who have to one-tenth of the amount received in the profits. The revenue for 1913 (last year) amounted to $30,000, and the expenditure to $21,002,000, to cost of mobilization and enhanced under war conditions the expenditure rose to $38,645,140 and the revenue to $4,400. The estimates for 1918 stood at $50,000,000 expenditure. For mobilization, government issued loans for $80,000,000 in 1914; $150,000,000 in 1915; $200,000,000 in 1916; $100,000,000 in 1917, and $150,000,000 in 1918. The public debt amounted to $1,490,010,000; including the debt of $2,427,000,000. There were 35 savings banks with 446,247 stockholders and $315,000,000 in deposits. In the total state property was valued at $29,000,000. The cantons separately hold $69,000,000, and the total of the country is normally about $50,000,000 annually. The salt monopoly produces about $7,500,000 a year. At the beginning of 1918, there were in circulation 10,880,000 gold coins of the face value of $40,520,000; 88,376 silver coins, face value $14,400,000; 143,700,000 nickel coins, face value $2,774,000 and 102,500,000 copper coins, face value $270,000—a total face value of $55,024,000. The national bank, opened in 1907, has the exclusive right to issue bank notes, of which it had in circulation on 30 March 1918 to the value of $139,125,860. Switzerland is a party to the Latin Monetary Union with France, Belgium, Italy and Greece. The franc is the unit of currency; its value in terms of United States money is $0.225, roughly 20 cents, or five francs to the dollar.

Swiss Army.—Compulsory universal service has been the root-principle of Switzerland's military system for centuries. Since the reorganization completed in 1912, the army has been brought to a high state of efficiency. The striking force of the Swiss army consists of about 300,000 men, divided into three parts: the Elite (20 to 32 years), the Landwehr (33 to 40) and the Landsturm (40 to 48), which numbers respectively 117,530, 108,900 and 68,000 men. The supplementary services (men of 20 to 48, not listed for the army) are paid for by a double number 205,000, and the Grand total of the whole army is slightly under half a million or one-eighth of the entire population. There are few exemptions except for physical disability and those excused or rejected pay certain taxes instead of rendering service. Liability extends from the 20th to completion of the 48th year; service is distributed as follows: 12 years in the Elite or "Auszüg"; eight years in the Landwehr and eight years in the Landsturm. The longest periods of training are the recruits' courses which every man goes through in his first year of service—65 days for the infantry, 75 for the artillery and 90 in the cavalry—besides which there are compulsory courses in shooting. The younger men (the first line) do seven other annual trainings of 11 days each (14 days in the artillery) before passing into the Landwehr, when they are called out for 11 days every four years; the Landsturm are only called up in time of war. Men convicted of have not been allowed to join the army and officers and men whose private life is unworthy of their rank and standing are court-martialed and dismissed. In the strictest sense a democratic service, the Swiss army is a model institution.
penditure is 11 francs ($2.20) per head of population, while 23 francs ($4.60) per head are spent on education. All men rejected for physical defects or exempted, teachers, clergymen, police, etc., pay a tax amounting in all the schools and cantons, and Service being the same for all, it is, the handicap for none. It interferes neither with personal liberty nor with the country's prosperity; it imposes little burden on the treasury and no burden at all on the content. In proportion to population Switzerland is one of the richest countries, as it has not an inch of territory beyond borders. The yearly value of Swiss commerce amounts to about $102 per head of the population, as compared with England, and the country not only being compulsory, but regards and affection the army which is its Owing to its inland position Switzerland no small fleet on Lake Zürich, with orders to oppose the French army, the latter, under Masséna, proved to be a success, and Russians, Williams calmly watch battle from the lake. Then, enraged at the inaction, he discharged his crews, scuttled vessels and took to flight.

History.—Switzerland is believed to have been first peopled by the Rhaetii, who were driven from the plains to the mountains by the Helvetii (q.v.), a Celtic tribe. The land is the oldest inhabitants of the country as is history; they were conquered by the Romans built military roads over the Alps and began to settle in the cantons of Avenches, in the canton of Vaud, which in the early centuries Christian era was the headquarters of man legion with its Rhaetian cohorts at Avenches, Houlte, Basel, Argovie, Saint Gall, Zürich and Schaffhausen. The sixth division (Italians and Romonches) is recruited from Ticino, the Grisons and Saint Gall. At the beginning of the European War all six divisions were mobilized so rapidly that in the first week of August 1914 Switzerland was able to post on its frontiers over 250,000 fighting men, well armed and well drilled. The infantry are armed with the Swiss repeating rifle. The field artillery consists of 75's and 120's (howitzers); the mountain artillery of 75's (1906 model) and the heavy artillery of 750's, firing a shell of about 39.68 pounds.

This national militia, which is not a standing army, is administered partly by the cantonal authorities, who have power to promote officers up to the rank of captain. The higher appointments rest with the federal government, which has charge of all general matters of importance. The Swiss consider it an honor to serve in the army and a misfortune to be rejected. Compassion and efficiency and the fact that it is raised by conscription, the Swiss army is a comparatively cheap one. The ex-
SWITZERLAND

1. Lucerne

2. Thun and the Bernese Alps
Switzerland had become a part of the
ish Empire, which did not take possession
ry with its own nationals, but
ed it through appointed officials. Chris-
 was introduced during this period and
omasities of Disentis (now a school); 
, named for Saint Gallus, an Irish
 and now a bishop's residence), and Ein-
 (now one of the most famous pilgrim
 in the world), were founded, and dukes
 and counts were appointed as vicerogents of
king's. Under the successors of
, Switzerland was divided: the
half was united with the duchy of
nia or Swabia (Schwaben), and the
part with the kingdom of Burgundy.

After the downfall of the latter in
the whole country fell to Germany, which
ed it through vicerogeents, the dukes of
agen. These governors in succession con-
emselves as princes, assumed the name
le castles, and compelled the free inhabi-
ty of Burgundy (districts) to acknowledge
 as their lords. They were in perpetual
 with the Burgundian nobles and con-
tly favored the inhabitants of the towns.
also founded several new towns, such as
m, Fribourg (Fribourg) and Burgdorf
out the Middle Ages, Switzerland and
ss were always in the eye of Europe.
es presented the spectacles of a
people repelling the tyrant and invader
unearthly courage and good luck; at
times it was that of a warlike clan, safe
great mountain fastnesses, offering their
bilities to the highest bidder and ren-
for pay as high a courage and stubborn
ity as was ever inspired by love of coun-
almost every European nation felt their
as enemies or allies. The Swiss was
at every court in some capacity. Peter
Prince of West Switzerland, built the great
castle in London, part of which survives
as the Savoy Chapel, built on the site
; he also built the famous Castle
 on Lake Geneva, immortalized by
, and kept great affairs going in both
far-apart countries. It is recorded that
velli prophesied that the Swiss would
day mark the site of present-day Switzer-
able enough then in the light of the
ble military virtue and energy of the
the power of the German emperors de-
d the nobles and priests were ambitious
pensibility and eager to enrich themselves
expense of their neighbors. Those of the
towns and smaller communities which
erved their freedom were compelled
raditions of safety to conclude treaties
feudal lords of the time. At the be-
the 13th century the three forest
of Uri, Schwyz and Unterwalden were
 to the then unimportant counts of Haps-
who, although they were properly only
al heiresses (Vögte), yet regarded them-
as sovereign rulers. This claim the three
constantly refused to admit, and eventu-
(1291) leagued themselves together to
the usurpations of the house of Haps-
Tradition says that on the night of 7
307, 13 Swiss representatives, with Furrin
son-in-law Tell, Stauffacher of Schwyz,
and Arnold of Melchtal in Unterwalden at
their head, met at Rüti, a solitary spot on the
Lake of Uri, swore to maintain their ancient
independence, and projected a rising of these
cantons for 1 Jan. 1338. On the day fixed
the rising took place, and the Austrian
herno were deposed and expelled. But the
events related of Tell are purely legendary. (See
Tell). A few years later the three cantons
were invaded by the Hapsburgs; but the signal
victory at the pass of Morgarten on 13 Nov.
1315, secured the independence of the cantons.
The three united cantons were joined by the
cities of Lucerne (1332) and Zürich (1351), the
cantons of Glarus and Zug (1332), and the city
of Bern (1333). Austria, which claimed juris-
diction over these of the newly-added members,
namely, the city of Lucerne and the cantons of
Glarus and Zug, again invaded the territory of
the confederation, but was completely defeated
at Sempach (where Arnold of Winkelried is said
to have sacrificed his life for the sake of his fel-
countrymen) in 1386, and in 1388 at Nafels.
The canton of Appenzell joined the confedera-
tion in 1411, and Aargau was wrested from the
Austrians in 1415. The third war with Austria
terminated in 1460, in favor of the confedera-
tion, which obtained Thurgau, Austria being
thus deprived of all its possessions in the regions
over which Switzerland now extends. Haps-
burg Castle still dominates the canton of Argau
—a monument of Swiss independence. In 1474,
at the instigation of Louis XI of France, the
Swiss turned their arms against Charles of
Burgundy, invading his country and defeating
his army near Héricourt. Charles, in revenge,
invaded Switzerland, but the Swiss inflicted
severe defeats upon the Burgundians at the	hree battles of Grandson, on the Vaud, Morat
(Murten) and Nancy in 1476 and 1477, in
the last of which Charles was slain. They admitted
Freiburg and Solothurn into the confederation
in 1481, and about the same time they con-
ducted defensive alliances with several of the
neighboring states. Their prosperity rose to
such a height that all the courts around, even
Austria, sought their friendship and alliance.
The last war with Austria broke out in 1498.
The Swiss had to undergo a severe struggle,
but, victors in six sanguinary battles, they were
by the Peace of Basel in 1499, practically sepa-
ated from the empire, a separation to which
formal and international sanction was given in
1648. That peace ended a triumphant strug-
gle of two centuries. After this war they had
no longer any enemy to fear, and their future
wars were waged on behalf of foreign powers.
In 1501 Basel and Schaffhausen, and in 1513
Appenzell (which had long been an ally), were
admitted into full federation. The number of the
cantons was brought up to twenty-four, at which it remained till 1798. The town
and the abbots of Saint Gall and the town of Bienne
had seats and votes in the diet without being
in full federation; and there were besides six
allies of the confederation not enjoying these
privileges—the Grisons, Valais, Geneva, Neuf-
châtel, Müllhausen, and the bishopric of Basel.
In 1516 France gave up to Switzerland the
whole of the present canton of Ticino. An alli-
ance between the two countries was formed which lasted until the French Revolution.
In 1518 the Reformation began to make its
way into Switzerland, chiefly through the efforts of Zwingli at Zürich. He fell at Kappel (1531), but his work was carried on by Calvin at Geneva. The effect of the Reformation for legislation and the government of the Swiss cantons "was at Wittenberg in 1517, when victory declared itself for the Protestants. The period of tranquillity that followed was alike favorable to the progress of commerce, agriculture and manufactures, and to the arts and sciences. In almost every department of human knowledge the Swiss of the 18th century, both at home and abroad, acquired distinguished reputation. In the last years of the century the ferment of the French Revolution spread to Switzerland, and in 1798 the ancient constitution was replaced by the Helvetic Republic, founded on the ruins of the ancient liberties of the nation, which lasted four years. In 1803 Napoleon I organized a new confederation, composed of 19 cantons, by the addition of Aargau, Grisons, Savoy, and Ticino, Thurgau and Pay de Vaud. In 1815, by the Federal Pact of Zürich Neufchatel, Geneva and Valais were admitted into the confederacy, and the number of the cantons was thus brought up to 22. This confederation was acknowledged by the Congress of Vienna, which proclaimed the perpetual neutrality of Switzerland, and the inviolability of its soil. Again in 1830 and in 1848, Switzerland was affected by the revolutionary movement in France, and a new federal constitution was introduced in the latter year. During the revolutionary commotions of 1848 Neufchatel set aside its monarchical form of government and adopted a republican one, and in 1857 it was put upon the same footing with the other cantons. Since that time the annals of Switzerland have little to record beyond the fact of constant moral and material progress. A revision of the federal constitution was adopted after a protracted agitation on 19 April 1874, from which time the cantons gradually adopted the referendum and the initiative. What this revision was going on of the individual cantons set the example of revising their constitutions. In this proceeding Zürich led the way, appointing a special council for the purpose in January 1868. It was followed by Bern, Aargau, Thurgau, Solothurn, and other cantons. All the modifications made were in a democratic direction. The chief opposition to the project of a revision of the federal constitution proceeded from the French cantons and the Ultramontane party, the former fearing that in consequence of a revision of the constitution in the direction aimed at, that of giving more power to the central authorities, they would be gradually Germanized, the latter believing that the influence of their party in those cantons where it was numerically strong would be curtailed. But in spite of this opposition the Federal Assembly, on 21 Dec. 1869, adopted the principle of a revision, and elected a committee to prepare a scheme for the purpose. The project of revision drawn up by this committee was laid before the Federal Assembly in the session of 1871-72, and after being accepted was submitted to the people on 12 May 1872, an article of the constitution then in force being adopted, adopted, he sanctioned by a majority of the people and of the cantons this occasion the 1869, and the 1870, by a majority; but a new one was drawn accepted on the date already mentioned, 1874. The new constitution gives more energy to the confederacy by asking federal authorities more power in relating to law, the army, the church, and nation. The laws of the various cantons are partially assimilated; the management of the national contingents to the army is no longer entirely to the cantons themselves; the astical authorities are completely subject to the civil power; and primary education compulsory and secular. Since then three partial revisions have been made. A constitutional modification, for instance passed by the National Council in 1891, effect that in future when a revision of the constitution, or the admission into new articles, is proposed by popular this proposal must be supported by the at least 50,000 citizens possessing a right voting, and not 30,000 as previously. The 600th anniversary of Swiss nationa celebrated. The more important events in Swiss of recent years may be briefly summarized: the last day of 1898 Switzerland was by the United States as a favored. In 1900 the nation rejected the "dou act," a scheme to elect members of the National Council by proportional repres. The new palace of the Swiss parliament opened in 1902. In the same year a future with Italy occurred. Agreement arrived at during 1903 for the constru the Jura and Simplon tunnels; a new was passed in 1907, when a British commission arrived at Basel to study the army system. In 1908 the sale and man of absinthe were entirely prohibited. country. During 1909 and 1910 a new age was caused by floods and avalanche recessive industrial development calls large supply of labor which Switzerland unable to supply; becoming every year of an agricultural country; means food have to be imported, while the factory hands has more than double years. The population of the country shows little increase; that of the to growing rapidly, mainly due to foreign immigration from Italy, France and, above a Germany. During the European War sion of Switzerland was one of extric -ity. Need of coal and iron comp republic to enter into an agreement with the Central Powers to supply them with fo. Besides maintaining its army on a war for the duration of the war, Switzerland came a clearing-house for the wounded and prisoners of all the b - while international diplomats and exis made it their headquarters. A not statement of Swiss policy was made in the somnium presented in February 1919 Federal Council to the Peace Conference. In this document emphasis was laid on Swiss neutrality, which is now according to circumstances, but is per
— a fundamental principle of the Swiss state since the beginning of the 16th century. As in the past, so in the future, Switzerland must remain the faithful guardian of the passes of the Alps. When all relations between the belligerents were broken off, Switzerland was able, thanks to its neutrality, to undertake the grateful task of carrying out a philanthropic activity which saved the world from an accentuation of its sufferings. Switzerland welcomed the creation of a League of Nations and, as the oldest of existing republics, would deem it an honor to bring into the League of Nations the experience acquired in the course of centuries. The determined insistence on neutrality by Switzerland—except in case of self-defense—places that country in a peculiar position with regard to the League of Nations. As pointed out by Professor Borgeaud in a pamphlet, "La Suisse et la Societé des Nations" (Geneva 1919), neutrality implies sovereignty, a principle inconsistent with the general spirit of the League. Nevertheless, indeed, the League in self-conceals this privilege for special international reasons. In a remarkable speech delivered before the National Council in August 1918 President Calonder first called attention to this point; though supporting intervention to end the war, he declared that Swiss neutrality prevented Switzerland from forcing itself as a peacemaker. Sturdy independence, freedom of action and avoidance of foreign entanglements or obligations is the keynote of the Swiss Republic. In a state paper dated 15 Nov. 1690 occurs this passage (in French): "The Swiss have two religions in their country, which divide them at times; but they have only one liberty, which they cherish above all: this reunites them always, and will reunite them for ever."

Bibliography.—(For Alps, see that head) — Adams and Cunningham, "The Swiss Confederation" (London 1899); Affolter, A., "Grundriss des Schweizerischen Staatsrechts" (Zurich 1904); Baedeker’s "Switzerland" (London 1913); Baker F. G., "The Model Republic: A History of the Rise and Progress of the Swiss People" (London 1895); Benson, E. F., "Winter Sports in Switzerland" (New York 1913); Bowerby, W., "The 36th Canton of Switzerland" (London 1892); Suter, L., "Histoire de la Suisse" (Einsiedeln 1914); Wade, Mrs. M. H., "Our Little Swiss Cousin" (Boston 1917); Webb, F., "Switzerland and the Swiss" (London 1909).

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SWORD. The, a weapon used in personal combat for cutting or thrusting, one of the most ancient and highly esteemed of all weapons. No sooner had the art of working metals been discovered than it made its appearance, replacing almost at once the crude axe of the Stone Age. The earliest swords, of which any authentic records exist, were those of the Assyrians, the Gauls and the Greeks. These swords were double edged, straight or tapershaped, and were made of bronze, the art of tempering steel not having then been discovered. The Roman sword, which was made of steel, was short, straight and double edged, having its point cut at an obtuse angle. The swords of the Franks were straight, about 30 inches in length with a tapering point. None of these swords appear to have offered much protection to the hand. During the Middle Ages the sword was lengthened, while still retaining its general Frankish shape and quillons (cross-pieces) were added for the protection of the hand. A narrow-bladed sword called the estoc, used principally for thrusting, was often carried attached to the saddle by mounted men, the heavy sword being worn upon the person at the same time. A dagger called the misericorde (dagger of mercy) was worn on the right side by knights, and used to dispatch their fallen foes.

The German lanzenquenets, or mercenary foot soldiers, used a two-handed sword some six feet in length. On the march this ponderous weapon was worn slung over the back. In wielding the heavy swords of the Middle Ages, the forefinger was often hooked over the right quillon to strengthen the grasp. This forefinger being unprotected (except by the gauntlet) was frequently injured and so, for its protection, a little ring was placed in front of the quillon through which the finger was passed. For the sake of symmetry another ring of the same kind was added to the left quillon, the two rings being termed the "pas d'ane." Side rings
were next added for the protection of the hand and the right quillion was curved upward so as to form the "knuckle bow." A thumb ring was also sometimes added, the Germans being especially fond of this device. During the 16th century the rapier became much lighter, the striking of heavy blows having become less of a necessity owing to the discarding of armor on account of the invention of gunpowder. A cup-shaped guard was added to the quillons (which were generally straight, the knuckle bow being retained as a separate piece) and the weapon became a rapier, the point of which rather than the edge was used in making an attack. With the early rapier a dagger was worn, which when fighting was held in the left hand and used for parrying. Later a cloak was used for the same purpose. As the science of fencing became better understood, however, all secondary protections were discarded, and the rapier became a weapon of both offense and defense. Rapiers were often highly ornamented and the guards were frequently fanciful design. The best of them came from Spain, Toledo being especially noted for the excellence of her blades.

Shortly before the beginning of the 18th century the rapier was supplanted to a great extent by the colichemarde, a weapon with a hilt like our modern small sword, the marked peculiarity of which was that its blade was wide for about half its length and narrow for the other half. About 1760 the colichemarde gave way to the small sword, a very light weapon, having a small circular guard, a knuckle bow and a narrow straight blade. The foil used in fencing which represents the small sword is about 33 inches in length with a quadrangular blade and a bell or ring guard. Italian foils have quillons, French ones do not. The dueling sword is a heavier kind of foil, having a triangular blade tapering to a very fine point. A broadsword is a sword that has a cutting edge. It may be either straight or curved, single or double edged. It is essentially a military weapon and is in use in all armies. In the United States army a form of sabre is used varying from 30 to 34 inches in length. In the Confederate States the broadsword has come into disuse among infantry officers owing to the lack of opportunity for its employment in trench warfare and the dangerous distinctiveness which it gives to those who bear it.

The sabre which is the best known form of broadsword is single edged. Its blade, which is usually somewhat curved, is thickest at the back, from whence it becomes gradually thinner toward the edge. Its guard consists of a strong knuckle bow often terminating in a solid piece, which simply protects the hand. The scimitar, a light form of sabre having a very pronouncedly curved blade is the favorite weapon of the East. Damascus was formerly noted for the excellence of her scimitar blades. The cutlass is a heavy broadsword which is in use by most of the navies of the world. The machete, a weapon much used in Cuba, is shorter than the cutlass and lacks the protecting guard for the hand. The claymore, which may be called the national weapon of Scotland, is a heavy straight broadsword having a very elaborate basket hilt.

The schlaeger, the weapon used by the German students in their university duels, is a long straight sword with a very sharp edge, having a solid metal guard which completely encases the hand. The sword bayonet is a short sword adapted for use either with or without the rifle.

The long sword of the steppes was much lighter, the striking of heavy blows having become less of a necessity owing to the discarding of armor on account of the invention of gunpowder. A cup-shaped guard was added to the quillons (which were generally straight, the knuckle bow being retained as a separate piece) and the weapon became a rapier, the point of which rather than the edge was used in making an attack. With the early rapier a dagger was worn, which when fighting was held in the left hand and used for parrying. Later a cloak was used for the same purpose. As the science of fencing became better understood, however, all secondary protections were discarded, and the rapier became a weapon of both offense and defense. Rapiers were often highly ornamented and the guards were frequently fanciful design. The best of them came from Spain, Toledo being especially noted for the excellence of her blades.

Sword-Dance. See Frikilege, under Ferns and Fern Allies.

Sword-Fish. See Globoideus.

Swordfish, an enormous mackerel-like fish (Xiphias gladius), representing alone the world-wide family Xiphidae. It has an elongate mackerel-shaped body which may equal in size that of the largest sharks, and whose muscles are astonishingly strong. A powerful forked tail, a lofty sail-like dorsal fin, and a long, cord-like anal fin are prominent in adults, but continuous in the young, and other strong fins, give the creature a power and speed in swimming equaled by few oceanic animals. The skin is naked, more or less rough, and the flesh red in color and rich in flavor. It is greatly enjoyed when eaten. These fishes are predatory, obtaining their food by fierce forays upon flocks of lesser fishes. Their strength and sharp teeth are supplemented by the prolongation of the fore part of the skull into a horizontally flattened "sword," composed of the consolidated vomer, ethmoid, and premaxillary bones. The excellence of this weapon and the power of attack is attested by the frequent piercing of boats and even of large wooden ships, through which the sword has been deeply thrust before breaking off. Although occasionally seen in the Pacific, the swordfish is characteristic of and numerous only in the North Atlantic, the Mediterranean Sea, and about the Antilles, where in summer it approaches the shore, in pursuit of schools of spawning fishes, and itself becomes the object of a profitable fishery, especially in Italian waters. Along the northern seaboard of the United States this is regarded as a prime summer sport. The fishermen cruise a few miles from the coast in small schooners, hav-
ing at the extremity of the bowsprit (from which the jibboom has been removed) a small plate carrying a belt-like rail of iron at the height of a man's waist, within which a harpooner may stand securely while his arms are free. Having sighted a swordfish, visible by its projecting backfin, the vessel is steered up and a harpoon is thrown accurately which is attached by a rope by which the catch is hauled aboard. Consult Goode, G. B., 'Fishery Industries' (Washington 1884).

SWORDS, Order of. See Orders (Royal) and Decorations.

SYBARIS, sib'a-ris, an ancient Greek city and colony of Lower Italy, in Lucania, on the Gulf of Tarentum, not far from the site of the later town of Thurii. Tradition ascribes its building to a colony of Achaeans and Thessalians about 720 B.C. It rapidly rose to a high degree of prosperity, but enervated by the mildness of the climate, the richness of the soil and their great wealth, the inhabitants became pro-

verbial for their luxury and voluptuousness. In a war with Crotona the city of Sybaris is said to have brought into the field 300,000 men, while the spoil of the former amounted to 100,000. The Crotonians, however, were victorious and totally destroyed Sybaris by turning the waters of the river Crathis against it (510 B.C.). The inhabitants of the town dispersed themselves for the most part over the other Greek cities of Lower Italy. Sybarite is still used to signify an effeminate voluptuary. In 1879 and in 1887 excavations revealed two great cemeteries but the true site of the city remains undetermined. Consult Notizie degli Scavi (Rome 1879-88) and Orsi, P., 'Atti del congresso di scienze storiche' (Vol. I, Rome 1904).

SYCAMORE, sikk'a-môr, Ill., city, county-seat of DeKalb County, on the Chicago and Great Western and the Chicago and North-western railroads, about 55 miles west of Chi-

cago. The city was founded in 1836. It is an agricultural and stock-raising region and has considerable manufacturing interests. The chief manufacturing establishments are flour mills, in-
sulated wire works, brick and tile works, sash and

factory windows, carriage works, agricultural implement works, varnish and furniture factories, canning establishments and creameries. There are large establishments for preparing fruit and vegetables for shipment. There are church, a young ladies' seminary and public graded schools. The national bank has a capital of $50,000; there is also a private bank. Pop. about 3,800.

SYCAMORE, a name applied originally to Ficus sycomorus, a tree known in biblical times and places, and the legendary one chosen by Zacchaeus to climb into for a sight of the Saviour. It is a species of fig, an evergreen timber tree, flourishing in Egypt, which sup-
plied an inferior coarse-grained wood for ordi-
nary purposes and for mummy cases. A famous Egyptian statue of an infant, Osiris, is on trunk and branches, edible and sweet-flavored and is a large item of food among the lower classes.

The ripening of the figs is hastened by making incisions in the apexes. In the Middle Ages a European maple, Acer pseudo-platanus, was selected to represent the tree of Zacchaeus in the old miracle plays, on account of it dense foliage. It is a tall, very handsome tree of quick growth and living for perhaps 200 years. The leaves are large and have acute lobes, somewhat resembling those of the plane, and the yellowish flowers droop in terminal racemes. The bark is smooth, often peeling off in large flakes, leaving patches of lighter color. The sap is saccharine and the wood is hard and white, although with a brownish heart, and takes a fine polish, being used by wheelwrights, turners, cabinet-makers and wood-carvers and for musical instruments. Sycamore endures sea and mountain winds better than most timber trees and is, therefore, planted for its shade in exposed places. Certain of these trees in Scot-
land were known as dool-trees, or grief-trees, because they formed informal gibbets on which to hang the enemies of thegovernment. Perhaps because of the likeness in foliage and the stripping of the bark, the name of syc-
amore has been again transferred to the Ameri-
can plane-tree (Platanus occidentalis) better known as buttonwood. The American trees with awkward, twisted, wide-spreading limbs which, however, when the tree is fully leaved out, forms a broad pyramidal head. The bark is smooth, that of the upper portion flaking off in pieces each year, leaving whitish patches, which are very conspicuous in winter. The large leaves range from simple coarse-toothed to distinctly dentoid and three-
lobed blades. The flowers are clustered in compact round balls, with from three to eight minute petals and sepals; the fruit-heads retain this globose form and are composed of obpyramid-
al nutlets, having long, nearly erect hairs at the base. They are usually solitary and swing on long peduncles during the winter, only fall-
ing apart in the early spring. The reddish-
brown wood is chiefly useful for cigar-boxes and is compact and difficult to split or to work. The Australian sycamore are Sterculia lurida and the white sycamore (Cryptocarya nov-
vata), one of the native nutmegs, and a large tree yielding serviceable white timber. Melia azedarach is the false sycamore, the large tree more commonly known as the pride-of-China tree.

SYCEE (si'sé') SILVER, the fine silver of China, cast into ingots weighing commonly rather more than one pound troy. They are marked with the seal of some banker or as-
sayer as a guarantee of purity.

SYCOSIS, a putrifiable disease of the skin of the bearded face. It is often called barbers' itch (q.v.) and may be regarded as a form of that disorder. The usual treatment consists of application of carbolic acid, zinc ointments, ichthyol, sulphur or oil of cade.

SYDENHAM, Charles Edward Poulett Thomson, 1st Baron, British statesman and governor-genius was carved out of a block of sycamore wood about 4000 B.C. The thick foliage, resembling that of the mulberry, makes the sycamore a desirable shade-
tree and it is still planted for this reason in Egypt. It is most of all by fruit and branches, edible and sweet-flavored and is a large item of food among the lower classes.
which he in 1834 became president and treasurer of the Navy. He became a recognized authority on financial matters and he was an earnest supporter of free trade. He was appointed governor of Canada in 1839 and it was under his administration that the union of Upper and Lower Canada was effected and a new constitution established. For his services in connection with this difficult undertaking he was in 1840 granted a pension of £1,000. He was preparing to return to England when he met his death during a hunting accident. Consult Poulett-Scrope, G. J., "Memoirs of Charles, Lord Sydenham" (1843).

SYDENHAM, Thomas ("The English Hippocrates"), English physician; b. Wynford Eagle, Dorset, 10 Sept. 1624; d. London, 29 Dec. 1689. He entered Oxford University in 1642 but his studies were interrupted by service as an officer in the Army of Parliament. He graduated in 1648 and was elected a fellow of All Souls College, but his medical studies were again interrupted by military service. He began practice at Westminster about 1655, for some time still giving much attention to politics. He was afterwards elected by the Royal College of Physicians in 1663 and took his M.D. at Cambridge University in 1676. While his medical studies were much interrupted and his early practice was without a medical license he made remarkable progress. He developed powers of diagnosis amounting to genius and he followed the method of Hippocrates in watching the progress of the patient and assisting nature in its effort to throw off disease. His theories were backed by his notable success in treating patients; and by his strong sense and plain manner of dealing with matters hitherto cloaked with professional mystery. He also kept mainly to simple prescriptions instead of the involved sort in vogue. He received recognition from abroad comparatively early in his career, his fame being largely augmented by his writings; but he made many enemies in the medical profession at home, although he also enjoyed the loyal support of many members of his profession. He made important contributions to medical science in his study of gout, of which he was a victim; his observations of epidemic diseases through a number of seasons and distinguished several that were formerly confused; introduced the cooling method of treating smallpox; was the first to use a tincture of opium, laudanum; and initiated the use of Peruvian bark in treating malaria. His scorn for dogmatic theories was intense and he was known in the case of a patient whose strength had been vitiated by the weakening processes of the day to prescribe food instead of medicine—an unheard-of procedure. His doctrines came into full recognition in the early part of the 18th century, it was then that the custom of designating him the "English Hippocrates" was inaugurated. However, while he felt keenly the antagonism evinced toward him by many members of his profession, he enjoyed a universal spiritual of the highest order and never suffered the ostracism endured by many pioneers in the new theories of medicine. Author of "Observationes medicæ" (1676); "Tractatus de podagra et hydrope" (1683); "Schedula monitoria de novae febris ingressu" (1688); "Proc.
SYDNEY, AUSTRALIA

1. Sydney, looking east from George Street into Bridge Street.

2. The beautiful residence suburb of Sydney, the house at the left of the picture, is "Cranebrook," the home of the Governor of New South Wales.
SYDNEY—SYLLABUS

ed ports, led, in 1901, to the formation of a port overseers, led, in 1901, to the formation of a port trust. This commission oversaw all the wharves, docks, and wharves, and considerably improved shipping at Sydney has 103½ miles of electric railway, which is mostly under municipal control.

SYDNEY, Canada, city, chief port of entry from which the capital of Cape Breton, province of Nova Scotia, situated on the westernmost part of Sydney harbor, 285 miles from Halifax; and on the Inter-

SYKES, Frederick Henry, American college president: b. Queensville, Ontario, 13 Oct. 1863; d. Cambridge, Mass., 14 Oct. 1917. He was graduated at Toronto University in 1885, and in 1891-95 was student, scholar and Fellow at Johns Hopkins University, where he took his Ph.D. in 1894. He was engaged in teaching in 1895, and in 1903 became professor of literature and director of extension teaching at Columbia University; and was professor of English and director of technical education at Teachers' College, Columbia, in 1903-13. From its organization in 1913 until 1917 he was president of the Connecticut College for Women. He was general editor of Scribner's 'English Classics Series'; and author of numerous textbooks on English composition and of 'French Elements in Middle English' (1890); 'Syllabus of Lectures on Shakespeare' (1903); 'Lectures of the History of English Literature in the Nineteenth Century' (1904), etc.

SYKES, George, American soldier: b. Dover, Del., 9 Oct. 1822; d. Brownsville, Tex., 9 Feb. 1880. He was graduated at the United States Military Academy in 1842. He was engaged in the closing scenes of the Seminole War and later in Texas, and served through the Mexican War. He was afterward on duty at western army posts and engaged in Indian warfare, and in 1855 was promoted captain. He was commissioned major of the 14th United States Infantry soon after the outbreak of the Civil War, participated in the battle of Bull Run, was commissioned brigadier-general of volunteers 28 Sept. 1861 and major-general 29 Nov. 1862. He commanded the Fifth Army corps at the battle of Gettysburg, and in April 1864 was transferred to duty in Kansas. He was brevetted brigadier-general in the regular army in 1865 in recognition of his services at Gettysburg and throughout the war. He became colonel of the 20th Infantry in 1868, and spent the remainder of his life at different western army posts. Congress appropriated funds for his burial at West Point, where a monument was erected to him.

SYLLABUS, a document issued by Pope Pius IX, 8 Dec. 1864, which condemned 80 current doctrines of the age as heresies. It is a summary or collection of errors previously repubhshed in various allocutions and encyclicals. It is a condemnation of the intellectual, social, and religious heresies, characteristic of modern times as these are in opposition to Roman Catholic doctrines. It was divided into 10 chapters, each containing several propositions with reference to their previous condemnations, under the following general heads: (1) Pantheism, Naturalism and Absolute Rationalism; (2) Moderate Rationalism; (3) Indifferentism and Latiudinarianism; (4) Socialism, Communism and Secret Societies; (5) The Adversary Supremacy of the Civil Power over the Church; (6) The right of the State to interfere in Spiritual things; (7) Morality independent or religious sanction; (8) The Sufficiency of merely Civil Marriage; (9) The Denial of the Temporal Independence of the Papacy; (10) Falsely styled *Liberalism.* The Syllabus Errorum was the occasion of much controversy and was seized upon by the German government as a pretext of
the famous May Laws against the Roman Catholic Church in that country. The syllabus reas-
serts all the claims of the mediæval papacy. It provoked conflict between the papal and the
civil power in Prussia, Austria and Brazil. "Syllabus" is the name also used for a decree
of Pius X (1907), condemning modernism in 65 propositions.

SYLLOGISM, in logic, an argument stated in full logical form, so that its conclusiveness
is manifest from the structure of the expres-
sion alone, without any regard to the meaning
of the terms. A perfect syllogism comprises
three and not more than three propositions, the
third being the one to be proved; this is called
the "conclusion"; the other two, called the
"premises," contain the means by which the
conclusion is arrived at. A syllogism may be represented thus in symbols,

All A is B.
All C is A.

All C is B.

Or with words instead of symbols:

All metals are elements.
Internal is a metal.

All metals are elements.

This syllogism is valid, because the conclu-
sion logically follows from the premises. For the "figures" and "moods" of the syllogism and
the rules for the construction of syllogism see
LOGIC.

SYLPHS, in ancient mythology, the name
given to the elementary spirits of the air in the
polytheistic-pantheistic system of the Paracel-
sists. The sylphs, like the other elemental spir-
its—the salamanders or spirits of fire, the
gnomes or spirits of earth and the undines or
spirits of water—form the link between im-
material and material beings, for though, like
men, they eat, drink, sleep, travel, sicken and
beget children, they resemble the more elevated
spirits in the liveness and transparency of their
bodies and their rapidity of movement; they
also know more of the present and the future
than man does. They have no soul, and there-
consequently suffer annihilation after death. Con-
sult Paracelsus, Liber de Nymphis, Syphs,
Pyrmis et Salamandris et Ceteris Spiritibus (Basel ed., 1590).

SYLT, silt, Germany, an island in the
North Sea, near the coast of Schleswig-
Holstein. It is 22 miles in length, and has an
area of 40 square miles. It consists largely of
sand dunes with some cliffs—especially near
Kamper. The Friesian inhabitants are chiefly
occupied in agriculture, stock-raising and duck-
trapping, and are renowned as stilt sailors.
The dialect is peculiar, but German is the school
and church language. The principal town is
Keitum; the port is near Munkmarsch, con-
nected by rail with Westerland. Lighthouses
stand between Wemmestadt and Kamper and
on the northern point of land. There is good
sea fishing about.

SYLVANITE, a native telluride of gold
and silver, containing 24.5 per cent gold and
13.4 per cent of silver. It usually occurs mas-
sive, but is often seen in curious skeleton
.crystalizations, due to twinning, and somewhat
rare ways, within Mica Schists, giving rise to the name, "graphic tellurium." In
individual crystals are rare and of highly com-
plicated, monoclinic forms, with perfect clio-
Pinocaidal cleavage. It is brittle; fracture un-
even; hardness only 1.5 to 2; specific gravity
very high, 7.9 to 8.3. Its color is usually silver-white or slightly yellowish;
streak gray. It is an important ore of gold
and silver in Transylvania (whence its name),
Colorado and California.

SYLVANUS, syl-ván’ús, in Roman mythol-
ogy, a rural deity, who is represented as half
a man and half a goat.

SYLVESTER, James Joseph, English
mathematician: b. London, 3 Sept. 1814; d.
there, 15 March 1897. He was of Jewish
parentage and was educated at Cambridge
University, where, however, his religion prevented
his taking his degree until after the passing of
the Tests Act in 1872; but he took his degree at
Trinity College, Dublin, in 1841. He became
professor of natural history at the University of
London in 1837; and in 1841 was called to the
chair of mathematics at the University of
Virginia. He remained there but a short time,
his frank expression of his opinion of the slav-
ey question making his stay impracticable.
He was connected with a firm of actuaries in
London in 1845-53, meantime writing brilliantly on
mathematics. In 1855-70 he was professor of
mathematics at the Royal Military Academy,
Woolwich. In 1877-83 he was professor of
mathematics at the newly-established Johns
Hopkins University; and while in America
he founded and was the first editor of the Ameri-
can Journal of Mathematics. He was called
in 1883 to the Savilian chair of geometry at
Oxford University and retained it until his
death, although he was not on active duty from
1892, when his sight failed. From 1870 he was
recognized as one of the leading mathematicians
of the world. He published a vast amount of
original work, chiefly in the form of contribu-
tions to scientific periodicals and to learned
societies. His researches dealt principally
with algebraic forms, although he also made con-
tributions to analytical and pure geometry,
mechanics, optics and astronomy. He exerted a
profound influence upon the study of higher
mathematics in America as well as in Europe,
and his genius as an inventor of mathematical
was accompanied by remarkable facility in in-
structing and inspiring his students. He was
also an able linguist and was deeply interested
in verse making, although he failed to make a
name in that field. He wrote in this connec-
tion 'The Laws of Verse' (1870). He was
elected a Fellow of the Royal Society in 1839
and was the recipient of many honors from
universities and learned societies both at home
and abroad. His mathematical works were
edited by Baker, H. F., 'Collecte Mathematical

SYLVESTER, syl-vé’s’tér, Joshua, Eng-
lish poet: b. 1563; d. Middleburg, Holland, 2
Sept. 1618. He is remembered by reason of his
translation, into English of the "Divine Weekes
and Workeis" of Du Bartas, a French Humanist
nobleman. It was especially popular with the
Puritans in both the Old and New World, and
was one of the sources of inspiration for Mil-
ton's 'Paradise Lost.' Anne Bradstreet, the
"First New England Poetess," was a noted em-
asteous admirer of Du Bartas, known to her
through Sylvester's version, and modeled her
SYLVESTER—SYMBOLISM

SYLVESTER, See Sylvester.

SYLVITE, native potassium chloride, KCl, isomorphous with halite or common salt, crystallizing in the isometric system. Its habit is cubic, the crystals often modified by the octahedron. It usually occurs in granular or columnar masses, or compact. The crystals have perfect cubic cleavage, fracture uneven, brittle; hardness, 2; specific gravity, 1.98; lustre vitreous; usually colorless or white; transparent when pure. It is soluble in three parts of water and tastes slightly more bitter than common salt, like which it is highly diathematic. It is mined in Sicily and very extensively at Sussfurt and Leopoldshald in Prussia, the production in 1902 amounting to 181,341 metric tons. It is used in the manufacture of potassium salts, especially the nitrate (saltpetre) and the carbonate (potash). It is also called sylvine and sylvicite. See Potassium.

SYLVIA, Jacobus (Latinized name of Jacques Dubois), French anatomist: b. Amiens, 1478; d. Paris, 14 Jan. 1555. He early devoted himself to mathematics and the learned languages, but in middle life turned to medicine and took his degree at the University of Montpellier, later entering the University of Paris at the age of 51. He taught anatomy at the college of Tréguier, and later at the University of Paris. He is generally credited with the invention of the use of injection in dissection, but it is said he taught it evidence points to its being known before he used it. He appears to have been an ardent disciple of Galen rather than an original investigator, but gained a great name in his profession. The Sylvian fissure, the Sylvian aqueduct and the Sylvian plexus are named for him.

SYMBIOSIS, a biological term introduced by De Bary to denote intimate and complementary partnerships between different organisms, as between the algoid and fungus elements in lichens, or between unicellular algae and radiolarians. A great number and variety of cases of symbiosis have been recorded among the lowest plants, but botanists find the subject more and more obscure and their decisions are by no means general. The effort to differentiate symbiosis from commensalism and parasitism has proved most baffling in many cases. The term "social symbiosis" has been given to the association of insects found in the communities of ants, bees, termites, etc., where many small aphids, beetles, etc., not at all related to their hosts, dwell in peace and in some cases seem to contribute to the general welfare as well as receive benefits. The subject has been discussed mainly in Germany. Consult Brandt in Archiv für Anatomie und Physiologie (Leipzig 1882); Hertwig, Oskar, 'Die Symboles' (Jena 1890); Keeble, Frederick, 'Plant-Animals: A Study in Symbiosis' (Cambridge 1891).

SYMBOL, a word of various meanings, derived from the Greek word symbolon, a sign, or symbola, a composition. In the early period of Christianity the word was often applied to the Creed and to the sacraments. It is also used to indicate, either in a religious or profane sense, an emblem, figure or type, something which specially distinguishes one regarded in a particular character, or as occupying a particular office, or holding a special place in legend or mythology, as a connotation, the trident which is the symbol of Neptune. See Symbols, Astronomical; Symbols, Chemical; Symbols, Mathematical.

SYMBOLIC LOGIC. See Logic, Symbolic.

SYMBOLISM. The word symbol is derived indirectly from the Greek symbolon, a sign or token. Symbolism is the art and doctrine of symbols; it is the knowledge of the treatment of symbols or of deciphering the occult intent of signs or symbols and especially in reference to things spiritual, a sign or token, which can or cannot be pictured, as with ideas, qualities, etc. To the Greeks the word symbolon meant signs of such clearness that the allusion and the object were practically coincident. Among the Greeks their hospitality ended in giving their guests, or exchanging with them, a memorial of the visit in the form of a wooden tablet, a die or a ring, broken into two pieces. The host retained the other half, and in case of a future meeting presentation of the halved token was a sure identification as one half fitted exactly into the fracture of the other half of the symbolon. It is claimed by authorities that the origin of symbolism is traceable to the hieroglyphics or pictorial writings of the ancient Egyptians and was transmitted from them to other nations by the Jews. The Egyptians symbolized their gods with animal forms or combinations of both human and animal form; thus Horus, the sun-god, took the form of a sparrow-hawk, the disc was the hieroglyph of the sun, hence the disc and the sun survived from the Assyrians, has its clear definition, and expressed also the victory of good over evil. The snake (uraeus) was symbol of death, hence, used as an attribute of the Egyptian kings, meant power of the living and death, just as the handled cross (ankh) seen held by gods and kings signifies life. The staff (was) was the Nile kings' symbol of authority and has retained that significance with most nations ever since. From insect life also the Egyptians obtained such important symbols as the scarab (Scarabaeus sacer), the "sacred beetle," which they worshipped as a symbol of divinity, carving its form on finger rings containing inscriptions to be carried as an amulet. As to the mythology of the ancient Greeks and Romans it is not clear to us whether at first they looked upon their gods as symbolic of the elements of the world surrounding them; certainly it is that they embody a very perfect system of the symbolism of Creation. With Uranus, god of the heavens above them, wedded to Gea, the broad-chested earth, bringing forth Cronus, god of the harvests, and Zeus, the light of heaven, springing forth from the heavens god; with the storm-siege tower mountain top of Olympus dedicated as seat of the gods and realm of the divine brood, poetic symbol-
ism could get no closer to the human accounting of nature. Contemporary writers appear to show the acceptance of the theogony as alle

goric if not symbolic, and symbolism played a big role in the mysteries and in orphism. And the Neo-Pythagoreans under Plotinus, Porphyry, Proclus and the Emperor Julian, etc. found by the ridicule and logic of the Christian apolo-
gists to acknowledge that Saturn, Jupiter, Mars, Minerva and Venus were but symbols under which with other myths they represented divine attributes and manifestations. Leaders in the

modern schools of learning begin to see that it is symbolism that is expressed in the mytholo-
gies of Egypt and India as well as of Greece and Rome. But the most universally practised
worship has been that of the sun-god, whose symbol, the swastika, dates back earlier than the Sanscrit, and which symbolic cross has always been a sacred sign and known as the "Wheeling cross" or "wheel of the law" with Buddhists. Representing the sun, when its hands point to the right, an ancient symbol of the earth's revolution in easterly direction when the hands point to the left (some times then termed suavastika), it is found as an ancient symbol all over the American continent, on pottery of our prehistoric races. In a slightly varying form this swastika, known as the "swajot", appears among the ancient Celts as a favored symbol, occurring very frequently among the Scandinavian nations of early days. Symbols such as the triskelion, tetraselvex, etc. are interesting but belong to the subject of symbols, not symbolism now under discussion. The Chinese live in an atmosphere of symbol-
ism, every decoration having symbolic motifs as the chief characteristic, and even the shapes of the vases and jugs are symbolic. Scattered all over their pottery, porcelain, bronzes and enamels we find such symbols as those of longevity: Kylin (unicorn), kwei (tortoise), ho (crane), lau (deer). Their mystic number eight, (Fa) shows forth in the Pa-pao or eight precious things; the Po-kwai or eight mystic trigrams, the astrologers' symbols; the Po-chi-

siang or eight Buddhist symbols, etc. From the vegetable kingdom they find symbolism in the peach (toa), token of marriage and longevity. Another symbol condition is also symbolized in the gourd (hu-lu) and the fungus (chi); and the bamboo (chih), pine (sung) and plum tree (mey) are symbol of three friends. With the Japanese symbolism is a large part of their life. Among such we find: A pine, bamboo, orchid and a chrysanthemum symbolize the "four wise men" of Confucius; a pine twig, wisps of straw and a red lobster are a New Year symbol combination; a moon, snow flake and a flower in conjunction are symbols of the changing conditions of nature.

Jewish Symbolism.—Like all other Oriental peoples the Jews practised their system of symbolism. Many symbolic rules and for-

mule occurred in the building of Solomon's Temple, if the result of the researches of the Pseudemus can be relied on. The rending of Jeroboam's garment by the prophet Ahijah implied the separation of Israel from Judah; the rainbow presented a sign or symbol of the pact between God and the earth; the law of circumcision was a symbol of the covenant of the body. Josephus writes that the high priest's vestments were in every detail of sym-

intent, the coat symbolizing the earth; the garment, heaven; the belly and pomegranate thunder and lightning; the ephod, the fu-

ments; and the interwoven gold, the glo-

God, the 12 Jewels of the breastplate, the stars of the zodige. Or as congregating the significance are the blood of the Paschal shearing of the hair of the Levites, wa-

and bathing and anointing as a ritual, th-
ing on of hands, etc.

Christian Symbolism.—While the re-

tive Christians in the Roman Empire used symbolic language of signs, this was not as a matter of choice but of necessity. Persecuted sect could not safely, even in Catacombs, express themselves in their writings on sarcophagi or chapel walls with comment; they had to hide their epistles, other written or depicted statements in that would not draw down destruction on Any originally conceived system of symbol expression, while having the congre-
gation doctrine would have brought some among the authorities as to the intent of strange symbols. Therefore we find these worshippers of the cross using an eagle, R symbol of Jupiter; they borrowed from signs of the zodiac, from symbols appa-

in the pantheistic mysteries, etc. And they, later, used the sign of the cross in half hidden in combination with an and symbol used by the pagans. A crude for a fish (now called a garuda or a mandorla) came symbol of Christ referring to a sim of sound, icthys the Greek word for fish from the fact that the letters therein serve as the Greek initials of the words: Christ, Son of God, Savior. The vine bute of Bacchus) was adopted as a symbol of Christian promise. The lamb, the palm Good Shepherd, would all be understood heaven contemporaries in a different sent than in the Po-pao or eight things; the Po-bao or eight things by the early Christians. Greater safety in the use of sy was afforded the Christians from the fact there were other persecuted sects with Roman Empire, who, for their forbidden initiative a well-developed system of use in public communications to the lows, a language undecipherable to the tiate. Inscriptions of these symbolic sions are found cut in the vast rock temp Egypt, in Syria, Asia Minor, Sicily, Great Britain and in France. A method of cating a knowledge of this sign language with the cult, was carried on unber by their persecutors. They formed them into literary societies, guilds, burial s, etc., all under license as legal colici, but secretly active as congregating doctrine propaganda instead of the absence gatherings. Among the systems of bolism adopted by the early Christians those belonging to the Pythagorean and tical doctrines and the sacred number 8 among them. But from 325 A.D. such was a state offense. Augustine made the symbolic language and declared it a ateristic of the Gnostics. This latter coming into existence after Gregory had already envisaged openly, endeavored to cut its principles with the Greek philosophy.
SYMBOLISM

such teachers as Saturninus, Basilius and Valentine a very extensive symbolic language was created in the Byzantine period and practised by these Gnostics, but the full intent of the expressions of this cult is lost to us at this day. Byzantine art discloses a considerable proportion of its symbols, such as the Abrazas, etc. As a matter of fact there is a close connection between Byzantine Christianity and Mithraism, from which much was derived, even if in changed form. And Byzantine art is built up entirely of symbolism, even to its very architecture, and it frequent lack of beauty from an artistic point of view is caused by its occultism in form and manners. Unlike the pagans, the Christians in their practice of symbolism always clearly distinguished the conventional signs from the divine and sacred essence they represented in their ceremonies or sacraments.

In covering the catacombs with such depicted figures as fish, lamb, shepherd, grapes, fountain and hart, ship sailing safely on rough seas; with theirprung to Chi Rho (“sacred monogram”), Alpha and Omega, etc., they set up no figures for idolatrous worship, but simple symbols of spiritual truth. C. S. Lewis characterized the ecclesiastical symbolism were Hugo of Saint Victor, Richard of Saint Victor, Vincent of Beauvais, Durandus, bishop of Mende, Languedoc, Honorius of Autun, Sicardus of Cremona, etc.

Symbolism attained its apogee in the Middle Ages, when animals, colors, plants, lines and attitudes had their hieratic significance. Candles, symbolic of the Light of the World, found ubiquitous use in all rituals; the vestments of the clergy, besides the ritual itself, were symbolic. The Church also had its representation in a woman crowned and majestic, bearing the banner of victory and the chalice, while Judaism, as unbelieving, took the form of an aged woman holding a cracked staff, the tables of the law falling to earth, her eyes bandaged and her crown toppling from off her head. Art was fond of depicting the universality of life’s uncertain tenure by illustrating the title of Death, a human skeleton calling, as unwelcome visitor, on king, queen and humble peasant. The books of Bestiaries afford us an insight into the allegorical or mystical significance of the most grotesque, monstrous animals of those days of superstitions. They figure on the gargoyles and in the moldings of Romanesque and Gothic structures. Much of the beauty of Gothic architectural traceries is found in the disposition of the trefoil and quatrefoil, having their symbolic intent of the Trinity and the four Evangelists. And the four Evangelists themselves enter the language of symbolism either as the “four rivers” or Matthew being represented as an angel, Mark as a lion, Luke as a winged ox and John as an eagle. The 12 Apostles were given each their symbol for recognition in art depiction; Saint Peter bearing a key, Saint Jude a cross, Saint Matthew a wallet, Saint Thomas a spear, Saint Simon Zelotes a baton, and so on. At least, from which our science of chemistry arose, was largely a science of mysticism and symbolism. It was probably derived from the Egyptians, not the Arabs as was formerly supposed, and Hermes is, after all, likely to have been the originator.

At first the view evidently was that metals in their changing forms (reactions) had body and soul like human beings, hence lead was called Osiris and considered by the Egyptians as the soul, or “prima materia” of all metals. Later it was supposed that quicksilver (mercury) was the soul of metals. And in the final determining of the alchemists (particularly through the Babylonians) used the planetary names for the metals thus:

<table>
<thead>
<tr>
<th>Planet</th>
<th>Symbol</th>
<th>Metal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saturn</td>
<td>♄</td>
<td>Lead</td>
</tr>
<tr>
<td>Jupiter</td>
<td>☉</td>
<td>Tin</td>
</tr>
<tr>
<td>Mars</td>
<td>♃</td>
<td>Iron</td>
</tr>
<tr>
<td>Sun</td>
<td>☉</td>
<td>Gold</td>
</tr>
<tr>
<td>Venus</td>
<td>♀</td>
<td>Copper</td>
</tr>
<tr>
<td>Mercury</td>
<td>☿</td>
<td>Quicksilver</td>
</tr>
<tr>
<td>Moon</td>
<td>☾</td>
<td>Silver</td>
</tr>
</tbody>
</table>

And from the hermetic books sprang our first knowledge of chemistry, in which the chemical contents wrap up in philosophy and religion the search for gold and the philosopher’s stone. And we learn from these students that the stone was “the world in little, microcosm, man: earth; fire; three, mercury, sulphur and salt, or spirit, soul and body.” And we find the alchemists speaking of men as metals and reading such an ancient authority as Issak Hollandus, it is difficult to differentiate between mankind and lead (which is called Saturn), but we are told by his interpreters that he must not be understood to speak of common lead but the lead of the philosophers. Great symbolists were the Rosicrucians, if we may believe what we read about them. From those who claim the origin and existence of the Rosicrucian fraternity as a probable existence of the past we are informed that the writings, ‘Fama’ and ‘Confessio,’ of the early 17th century in mentioning therein the gold which they alchemically created it was “not the gold of the multitude but it is the living gold, the gold of God.” Symbolism, therefore, pure and simple. And later the brotherhood (in England) under Frarius and Fluid transform the ritual into Fice of Death. Its symbolism is stated in the “Summum Bonum.” The Renaissance and Reform arrested the science of symbolism.

The science of heraldry is largely one of symbolism and the numerous crosses have in past days had authorities who deciphered the symbolic intent of their variants, as well as the meaning of many other “charges.” Symbolism has been applied to a language of flowers, as well as to colors, numbers, etc. And each of these fields of application have been more or less adopted by the Christian Church in its symbolism.

The term “symbolism” is used in the technique of psychoanalysis to define a certain brain reflex action, as in dreams, etc. In the method of psychoanalysis there are two spheres or states of the mental process; they are designated the “preconscious” and the “unconscious.” Much of the “unconscious” brain action is what the psyche or unconscious meaning what is known to the lay world primitive or animal. Symbolism in this teaching has a very broad aspect as is disclosed by such an authority as Wm. A. White in the following expression: “For what after all is a word but...
a symbol of an idea and an idea but the symbol of a thing. 9 Whether or not we see the symbolism of a given expression, for example, depends upon the closeness of analogy between the sign and the thing signified. The closer the analogy the less the symbolism and the less easily the symbol grasps the deeper essence of the idea. Symbolism is a mode of expression, the psychological or spiritual thing in the outside world and the word symbolizes the idea. From this point of view our thinking takes place by the use of symbols. 5 In its action, we are told, the symbolism of a word may assume dynamic force (energy). In such dynamic symbol words are included - pride, patriotism, etc. This medical conception and theory of symbolism is claimed to be of assistance in indicating the true inwardness of certain neuroses, as hysteria, etc.


Clement W. Coblue.

SYMBOLISTS, the name of a group of French writers and their imitators in other countries whose school arose in the eighties and at first was supposed to indicate a reaction against Parnassianism and realism. The school or rather style was inaugurated by Philippe Auguste Mathias Villiers de l'Isle-Adam (1838-89) whose play 'Axél' remains the typical drama of the Symbolists. The Symbolists are so called from their habit of introducing an object or being merely as an expression of an idea. Dreams, mythology, music, are their favorite subjects, which they commonly interpret in lyric verse. Form and expression count more with them than substance. Their characters are often degenerate, their themes repulsive, their wit redolent of the gutter and their notions of art rather subservient of morality than otherwise. They were frequently called Décadents, especially the earlier followers of Baudelaire. Jean Moréas (1856-1910) was at first one of the defenders of the principles of the Symbolists and from the apellation of decadent and justifying their innovations as the natural development of the prosody of Baudelaire, Mallarmé and Verlaine. Later he returned to the older forms of versification and to the classical tradition. Other prominent figures among the Symbolists were Gustave Kahn, Catulle Mendès, De Rémé, the Belgians Maeterlinck and Rodenbach, the Americans Vielé-Griffin and Stuart Merrill, the Irishmen John M. Synge and William Butler Yeats and the Englishman Aubrey Beardsley, whose unworthy pictorial productions certainly classify him with the Symbolists. The most beneficial innovation of the Symbolists lay in their attempts to break away from the formalism and stiffness of French versification in their attempts at rhymed prose or vers libre. They abandoned rhyme and the fixed traditional forms and revelled in assonance, repetition and generally attempted to make their lines the visible counterpart of their themes. (See FRENCH LITERATURE). Consult Barre, André, 'Le Symbolisme' (Paris 1911); Gourmont, Rémy de, 'Le livre des masques: portraits symbolistes, gloses et documents sur les écrivains' (Paris 1896); Külling, G., 'Le Symbolisme' (C. v. 1896); Kahn, Gustave, 'Symbolistes et décadents' (ib. 1902); Pellissier, G., 'Etudes de littérature contemporaine' (ib. 1898); Symons, Arthur, 'The Symbolist Movement in Literature' (London 1899).

SYMBOLS, Astronomical, signs or symbols some of them very ancient, which conveniently represent astronomical objects, phases of the moon, etc., and astronomical terms. They are:

**SYMBOLS OF THE HEAVENLY BODIES.**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>planets</th>
<th>stars</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sun</td>
<td>☀️</td>
<td>June</td>
</tr>
<tr>
<td>Mercury</td>
<td>☿️</td>
<td>Vesta</td>
</tr>
<tr>
<td>Venus</td>
<td>☉️</td>
<td>Jupiter</td>
</tr>
<tr>
<td>Earth</td>
<td>☽</td>
<td>Saturn</td>
</tr>
<tr>
<td>Moon</td>
<td>☽</td>
<td>Uranus</td>
</tr>
<tr>
<td>Mars</td>
<td>☿️</td>
<td>Neptune</td>
</tr>
<tr>
<td>Ceres</td>
<td>☿️</td>
<td>Comet</td>
</tr>
<tr>
<td>Pallas</td>
<td>☿️</td>
<td>Star</td>
</tr>
</tbody>
</table>
The asteroids, except the four given here, are represented by a circle with a number, thus, 9, designates Angelina, the sixty-fourth asteroid, in order of discovery.

**LUNAR PHASES.**
- Moon in conjunction, or new.
- Moon in eastern quadrature, or first quarter.
- Moon in opposition, or full.
- Moon in western quadrature, or last quarter.

**SIGNS OF THE ZODIAC.**
- Aries ........... ♈ Libra ........... ☉
- Taurus .......... ♉ Scorpio ......... ♏
- Gemini .......... ♈ Sagittarius ...... ♑
- Cancer .......... ♎ Capricornus ...... ♐
- Leo ............. ♎ Aquarius ......... ♒
- Virgo .......... ♍ Pieces ............. ☊

**PLANETARY POSITIONS.**
- Ascending node .... ♒ Eastern Quadrature ☐
- Descending node .... ♒ Wester Quadrature ☐
- Conjunction ........ ♒ Trine .......... ☐
- Sextile ........... ♒ Opposition .......... ☐
- Quadrature .......... □

**ASTRONOMICAL CONTRACTIONS.**
- Right ascension, R.A. ☉, or α.
- Declination, Dec. or δ.
- North polar distance, N.P.D.

**SYMBOLS, Chemical, letters or symbols used in chemistry to designate the various chemical elements.** They are merely the first letters of the names of these elements (not in every case of their English name); or when the names of two or more elements begin with the same letter, two letters are used as the symbol, one of which is always the first letter of the name of the element. Generally speaking the letters comprising the symbol are taken from the English name of the element; but in some instances, specially in the cases of metals which have been long known, the symbols are derived from the Latin names: thus we have Hg, symbol for mercury, from the Latin Hydrargyrum; Fe, from the Latin Ferrum, for iron; and so on. In a few cases the symbols are deduced from the old German names: thus K, the symbol for potassium, is the first letter of the old German word Kalium, and Na, the symbol for sodium, is from the German Natrum. However derived, whether from English, German, Latin or French, the symbols of the chemical elements are universally the same. For a considerable time French chemists employed the symbol As to represent nitrogen, from the name Azote, which was given to this element in reference to the fact that it alone could not support life (Greek, a, privative, and ze, life); but this symbol is now almost entirely superseded by the letter N. The symbols of chemical compounds are constructed by placing together the symbols of their constituent elements, a number being attached to each signifying how many atoms of the element enter into the composition of the amount of the compound expressed by the entire symbol. For it must be understood that chemical symbols have a quantitative as well as a qualitative meaning. When a chemist meets in a chemical treatise with the symbol O he knows that this signifies not only oxygen but a certain definite amount by weight of oxygen, O always means 16 parts by weight of oxygen, so Fe means 56 parts by weight of iron; and so also the compound symbol FeO₃ means (56 × 2) + (16 × 3) = 160 parts by weight of oxide of iron. For a further account of the uses and modes of formation of chemical symbols see the article CHEMISTRY.

**SYMBOLS, Mathematical, signs or abbreviations used in mathematical operations for the sake of brevity and to facilitate expression.** In arithmetic and algebra there are four general kinds of symbols used; namely, those of quantity, operation, relation and abbreviation. Quantities are generally represented by letters. Known quantities are represented by the leading letters of the alphabet, or by the final letters with one or more accents, thus: \( x', x'', y', \) etc. Unknown quantities are represented by the final letters of the alphabet, as \( x, y, z \), etc. Besides the English letters, those of the Greek alphabet are often made use of. Certain letters have come to represent certain quantities. Thus, \( \pi \) generally stands for the ratio of the diameter to the circumference of circle, or the number 3.1416; \( e \) denotes the base of the Napierian system of logarithms, or the number 2.718281828; \( M \) denotes the modulus of any system of logarithms. The symbol \( \infty \) denotes an infinitely great quantity.

Of the symbols of operation the sign \( + \), plus, when written between two quantities, signifies that the second is to be added to the first; as, \( a + b \). The sign \( - \), minus, when placed between two quantities, denotes that the one on the right is to be subtracted from the one on the left; as, \( a - b \). The sign \( \times \), when placed between two quantities, denotes that the one on the left is to be multiplied by the one on the right; as, \( a \times b \). Multiplication may be indicated by placing a point between the factors when they are both expressed by letters; as, \( a \cdot b \). This method is not applicable when the factors are numbers, because, in that case the indicated product would be confounded with a mixed decimal fraction; thus, 5,6 instead of being read, product of \( \frac{5}{6} \), would be read \( 5 \frac{6}{10} \) and 6-tenths. There are cases, however, where the symbol is used between numerical factors, as in series where the factors follow a law which it is desirable to keep before the eye; thus the general term of the binomial formula is
\[
m(n - 1)(n - 2) \ldots (m - n + 1) = a \cdot x^{m-n}.
\]
The sign \( \div \), placed between two quantities, indicates that the one on the left is to be divided by the one on the right; as, \( a \div b \). Division may also be indicated by writing the quantities in place of the points; as, \( \frac{a}{b} \) or \( a : b \), or \( a/b \), \( a/b \). The sign \( \sim \) denotes the difference between two quantities, without
implying which is to be subtracted from the other; as, \(a \sim b\). The sign \(\sqrt{\cdot}\) is called the radical or evolution sign, and when placed over a quantity indicates that its root is to be taken; as, \(\sqrt{a}\); the degree of the root is indicated by a number written over the sign, which is called the index of the root or radical; thus \(\sqrt[3]{a}\), \(\sqrt[n]{a}\), etc. The sign \(\sqrt[\cdot]{\cdot}\) indicates the square root.

A vinculum (\(\bar{\cdot}\)) bar \(\cdot\) brackets \(\{\cdot\}\), parenthesis \((\cdot)\), etc., indicate that the quantities enclosed by them are to be regarded together; as, \((a+b)\times, a\times b\), etc. The symbol \(\sum\) denotes that \(+\cdot\)

the algebraic sum of several quantities of the same nature as that to which the symbol is prefixed is to be taken, thus,

\[
\sum_{n=0}^{\infty} \frac{q^n}{n!} = \frac{1}{p} \left( e^n - 1 \right)
\]

is a formula, in which \(p\) being constant and \(q\) and \(n\) arbitrary, signifies that the algebraic sum of any number of terms deduced by attributing values to \(q\) and \(n\) is equal to \(\frac{1}{p}\) multiplied by the difference of the algebraic sum of the terms, which are deduced by attributing the same values to \(q\) and \(n\) in the expressions \(\sum\frac{q^n}{n!}\)

and \(\sum\frac{q^n}{n!} = \frac{1}{p}\). Of the symbols of relation \(f, F, \phi, \theta\), written before any quantity, or quantities, separated by commas, as \(F(x), f(x, y), \phi(x, y, z), \theta(x, y, z)\), etc., denotes quantities depending upon the quantity or quantities within the parenthesis, without designating the nature of the relation. The sign of equality, \(=\), between two quantities, denotes that those quantities are equal to each other. The sign of inequality, \(>\), placed between two quantities, denotes that the one placed at the opening of the sign is greater than the one placed at the vertex of the sign; thus, \(a > b\), \(a\) is greater than \(b\); but \(a < b\), \(a\) is less than \(b\); also, \(a \geq b\), \(a\) is not greater than \(b\); \(a \leq b\), \(a\) is not less than \(b\). The sign \(\neq\) is a negation of equality; as, \(a \neq b\), \(a\) is not equal to \(b\). The signs of proportion \(::\), \(\because\), placed between quantities, taken two and two, show that the quantities are in proportion; thus, \(a : b :: c : d\), is read, \(a\) is to \(b\) as \(c\) is to \(d\). The first and third signs are signs of ratio, and the second the sign of equality, so that the above might be written

\[
\frac{b}{a} = \frac{d}{c}
\]

Of the symbols of abbreviation the sign \(\therefore\) stands for therefore or hence and \(\because\) stands for since or because. Other algebraic and mathematical symbols are \(\%\) for per cent or \(\times\) for per thousand; \(\#\) the symbol of integration; the Decinal, as in 5.6 (America), 56 (Great Britain), 56 (Continental Europe), meaning 5 and 6-tenths; identity \(\equiv\).

Geometry borrows most of its symbols from those of algebra just explained. Magnitudes are represented pictorially; the symbols \(\angle \angle\) are pictorial representations of angle, angles. \(\parallel\) means parallel to; \(\perp\) perpendicular to; \(\Delta, A\) represent pictorially the terms triangle and triangles respectively; while \(\odot, \odot\), represent circle, circles; \(\square, \square\), square, squares; \(\equiv\), \(\equiv\), \(\equiv\), represent parallelogram and parallelograms. Arc is represented by the symbol \(\equiv\) and radian; \(\equiv\), \(\equiv\), \(\equiv\), means congruent to and \(\equiv\) similar to. See Notation and consult Cambr., M. B., 'Vorlesungen über Geschichte Mathematik' (Leipzig 1910); 'Vorschule zur Vereinheitlichung der Mathematischen in Schulanstalt,' in 'Schulen des deutschen Ausschusses für den mathematischen und naturwissenschaftlichen Unterricht' (ib. 1913). This contains an extended list of symbols.

SYME, sim., James, Scottish surgeon; b. Edinburgh, 7 Nov. 1799; d. 26 June 1870. He was educated at the university of his native city, and studied anatomy under Barclay and Liston, visiting also Paris and Germany. In 1829 he opened Minto House Hospital, which he carried on for four years with great success as a surgical charity and school of clinical instruction; and in 1833 was appointed professor of clinical surgery in Edinburgh University. In 1847, on Liston's death, he became professor in University College, London; he soon, however, returned to his former chair in Edinburgh, and continued to hold it till his death. Among his numerous writings are a 'Treatise on the Excision of Diseased Joints'; 'Principles of Surgery'; 'Diseases of the Rectum' (1838); 'Pathology and Practice of Surgery' (1848); 'Stricture of the Urethra' (1849). Consult Paterson, R., 'Memorials of the Life of James Syme' (Edinburgh 1874).

SYMEONIS ('SIMMONS'), Henry, the hero of the most persistent and unique feud in history: Oxford University having for nearly 600 years (till 1827) required every candidate for the baccalaureate to swear war, not even against Symeons' posteriority, but against allowing himself, centuries dead, to be 'reconciled.' The only explanation hitherto given in a cyclopædia is an incredibly silly guess of Brian Twyne in 1668, that Symeon had feigned the baccalaureate before attaining it, and that his rite would never have gobbled him for the ages. In fact, the cause was precisely his not being a student at all. He was a wealthy citizen of Oxford, who about 1242, in the first historic sworn and gown row, killed a student and fled into exile from the vengeance of the others. Against their protest Henry III allowed him to compound for £80 (some £5,000 now) and return to stand trial. The university seems to have fought this off for nearly 20 years; and when overborne in 1254, they made this at least one grievance for most of them removing to Northampton. Simon de Montfort on mastering the king in that year recalled them; presumably, therefore, Symeons' permit was rescinded. At all events, the university exacted an oath from all degree men thereafter not to consent to any new baccalaureate — that is, peaceable residence in their town. It was retained after his death in terroriam as a warning to all who might molest Oxford students; and at last mummied as part of a set of historic victorics not to be canceled, though this one was long forgotten.
SYNGTON, William: British engineer and inventor; b. Leadhills, Scotland, 1763; d. London, 22 March, 1831. He was educated at the universities of Edinburgh and Glasgow, studying for the ministry, but abandoned that profession to become a civil engineer. In 1787 he took out a patent for an improved form of steam-engine, and in 1802, after years of futile attempts, he succeeded in propelling the tugboat Charlotte Dundas by means of steam-engines with which he had fitted her. He gained the patronage of the Duke of Bridgewater, but the death of the duke in 1803 left him without the financial support necessary for the promotion of his venture, and being unable to gain it elsewhere, he drifted from place to place, finally dying in poverty.

SYMMACHUS, Pope (498–514): b. Car-dinia (?); d. Rome, 19 July 514. He was baptized at Rome, entered the ranks of the clergy and was ordained deacon. He was elected and consecrated Pope 22 Nov. 498, succeeding Pope Anastasius II. However, a minority of the Church of Byzantine learnings, met on the same day and elected the Roman archbishop Maximianus as Pope, and a bitter dispute ensued. The matter was carried to Theodoric, the Gothic ruler of Italy, who decided in favor of Symmachus as having been elected first and by a majority. The Byzantine party, persisted in its efforts to seat Laurentius, established him in Rome and gained control of seven churches. It brought various charges against Symmachus, but after many sittings and much controversy the Synod reached the momentous decision that the Pope is above him (ecclesiae sacerdos) 505 or 506. The order of the Pope to the ordered Laurentius to surrender the churches held by him and his followers and the dispute came to an end. The remainder of Symmachus' reign was uneventful, except in the way of quiet progress. He formulated rules for the sale of Church property which were of great benefit to the Church; and his name is connected with the building or decoration of various churches in Rome.

SYMMACHUS, Sim'a-kús, Quintus Aurelius, Roman statesman of the 4th century. He was educated in Gaul, and after serving as quaestor and praetor became co-rector of Lucania and Bruttii (365) and consul of Africa (373) and member of the pontifical college. His petition to Gratian, urged on the Senate's behalf, for the restoration of the altar of Victory, proved unavailing (382), as did the ex tant letter addressed by him when prefect of the city (384) to Valentinian. The failure led him to side with the pretender Magnus (387), and for so doing he was impeached of treason, but pardoned and raised to the consulship (391). There remains of his works 10 books of letters and fragments of orations. These are contained in Seeck, ‘Monumenta Germaniae Historica: Auctores Antiquissimi’ (Vol. VI, Ethelbert Dilh., S. Roman Society) (London 1899); Dimsdale, M. S., ‘History of Latin Literature’ (New York 1915).

SYMMES, Sim, John Cleves, American soldier and author; b. Sussex County, N. J., about 1780; d. 1829. In 1802 he entered the United States army as ensign and served through the War of 1812, reaching the rank of captain in 1813. At Niagara and the Fort Erie sortie he won distinction. After the war he lived at New York, and in 1822 published a work propounding his own planetary theory, which comprised the belief that planetary bodies, including the earth, consist of hollow concentric spheres open at their poles. The inside of the earth he believed to be inhabited, and he imagined an aperture (known since as ‘Symmes' Hole’) in the earth's crust, near latitude 82° N., communicating with the interior of the planet, where he fancied plant and animal life to exist, and which he described as being lighted with two subterranean suns, Pluto and Proserpine. Humboldt stated that he and Davy had repeatedly been invited by Symmes to descend through this hole to the earth's interior. In 1822 and in 1823 Symmes petitioned Congress for an expedition to test his theory. Jules Verne is said to have made this idea the basis for his story, A Journey to the Centre of the Earth. Symmes advocated his views in lectures and pamphlets, and in a work entitled ‘Theory of Concentric Spheres’ (1826), Consul Atlantic Mankind (April 1873, Symmes' Theory of the Earth).

SYMMES' HOLE. See Symmes, John Cleves.

SYMMETRY. From the Latin symmetria; proportion, symmetry; which, in turn was derived from the Greek symmetria, meaning agreement in dimensions, proportionate. In its present-day intent the word symmetry in the language of the laity can be defined as harmony or balance in the proportions of parts as to the whole.

In geometry.—Two points are said to be symmetrical with respect to a straight line, when the straight line bisects at right angles the straight line joining the two points. Thus in Fig. 1 the two points $P$ and $P'$ are symmetrical with respect to the line $MN$, if $MN$ bisects $PP'$ at right angles. In such a case the line $MN$ is termed the axis of symmetry. Two figures are said to be symmetrical with respect to an axis when every point in one figure has its symmetrical point in the other. Thus in Fig. 2 the figures $ABC$ and $A'B'C'$ are symmetrical with respect to the axis $MN$, if every point in the figure $ABC$ has a symmetrical point in $A'B'C'$ with respect to the median line $MN$. When figures are symmetrical with respect to an axis, by revolving either about the axis and superimposing one over the other, they will be found equal and similar. Two points are said to be symmetrical to a third point, when this third point bisects the straight line joining the two points. Thus in Fig. 3, $P$ and $P'$ are symmetrical with respect to $A$, if the straight line $PP'$ is bisected at $A$. And the point $A$ is called the
centre of symmetry. Two figures are said to be symmetrical with respect to a centre, when as in Fig. 4, the triangles \( A \, B \, C, \, A' \, B' \, C' \) are symmetrical to the centre \( O \), and every point in the triangle \( A \, B \, C \) has a symmetrical point in \( A' \, B' \, C' \). A figure is symmetrical with respect to an axis when it can be divided by that axis into two figures symmetrical with respect to the axis. And a figure is said to be symmetrical with respect to a centre when every straight line drawn through that centre cuts the figure in two points symmetrical with respect to this centre. In solid geometry when two planes intersect they are said to form a die
dral angle. When three or more planes meet in a common point, they are said to form a poly
dedral angle at that point. Two polyed
dal angles are symmetrical, when the face and
dielral angles of one are equal to the face
dielral angles of the other each to each,
but arranged in reverse order. As example
the tri
dedral angles \( S \, A \, B \, C \) and \( S' \, A' \, B' \, C' \)
in Fig 5) are symmetrical when the face-angles

In algebra a function of several quan
tities which is not changed when any two of the
quantities are interchanged, such as \( \alpha \, \beta \), is
called a symmetric function of the quantities.
Such a function of the root of the equation
has been designated by enclosing the exponents
in brackets, expressing the repetition of a num
ber by an exponent: thus \( \alpha^a, \, \beta^b, \, \gamma^c \) — \( a, \, b, \, c \)
is written \( \{ \alpha^a, \, \beta^b, \, \gamma^c \} \). In particular, a symmetric
function of the form \( \{ \alpha \, \beta \, \gamma \} \) = \( \alpha^a + \beta^b + \gamma^c \)
is called an elementary function (Decker).

Physiology.—In the science of biology ani
mals are distinguished as Radially symmetri
cal; bilaterally symmetrical; serially symmetri
cal; assymmetrical. This is a division ac
gording to their structure internally and ex
ternally. In a radially symmetrical animal
such as a jelly-fish, the body can be halved by
a number of vertical planes — it is symmetrical
around the median vertical axis. In other
words it is of the same conformation all round
and possessing neither right nor left.

Symmetrical spherical triangles are those in
which the sides and angles of the one are
equal respectively to the sides and angles of the
other, but arranged in the reverse order. Thus
the spherical triangles \( A \, B \, C \) and \( A' \, B' \, C' \)
(Fig. 6) are symmetrical when the vertices of

the one are at the ends of the diameters from
the vertices of the other (antipodal). Two
symmetrical triangles are mutually equilateral
and equiangular; yet in general they cannot be
made to coincide.

In crystallography which deals with the angular
construction of crystals. The faces or outer sur
faces of crystals are arranged according to
certain laws of symmetry and, based on these
natural laws of symmetry, crystals are divided
into groups and systems. As in geometry, the
relationships of the planes to one another are brought under the heads of the **plane of symmetry**, the axis of symmetry, and the **centre of symmetry**. All may be combined in the same crystal, some have neither characteristic. Study of the conditions has brought the conclusion that there are 32 natural groups among crystals based upon their symmetry. As to *planes of symmetry*, these occur when for each face, edge or solid angle there is another similar face, edge or angle which has a like position with reference to this plane. Thus in a crystal of amphibole it is symmetrical with reference to a central plane of symmetry and, in ideal cases, it is called the **right symmetry**, having for every point on one side of the plane of symmetry its corresponding point at equal distance on the other side. Each half is a **mirror image** of the other half. In some crystals may be found as many as nine planes of symmetry, three of one set and six of another. This is exhibited in the cube. As to **axes of symmetry**, these occur in crystals when, as in geometry, a solid can be rotated through a certain number of degrees about some line as a result of reflection in a plane at a precise angle to itself or reflection in a plane at a precise angle to itself and at a plane parallel to it. The crystal remains itself in a complete revolution of 360°. Thus the axes are **binary**, **trigonal**, **tetragonal**, etc. As to the **centre of symmetry**, most crystals have besides planes and axes of symmetry or without either, a symmetry with reference to a point, its **centre**, as in the triclinic crystal in which every face, edge and solid angle in one half has a face, edge and solid angle in the other half. In such crystal the geometrical conditions we termed **compound symmetry** with reference to axes of binary symmetry and a plane normal to it, if the crystal is calculated as divided into two similar halves by a plane parallel to any one of its faces and one half be rotated 180° about an axis normal to this face. Crystallography exhibits **pseudosymmetry** when their angles apparently approximate in symmetry to the requirements of a system higher in symmetry than that to which in fact they belong. The micas show this tendency, being truly monoclinic in crystallization yet it is believed, at times, rhombohedral or orthorhombic. Grouping crystals according to their symmetrical forms crystallography creates the following divisions: Isometric system; tetragonal system, hexagonal system, orthohombic system, monoscopic system and triclinic system. See **CRYSTALLOGRAPHY.**

**Symmetry in Art.**—In this subject, as in all art matters, we have to go back to the classic Greeks, from whom, as we have seen, the word symmetry itself is derived. And in art circles for numerous generations the term has been the subject of much controversy, hence, according to the evidence introduced and the strength of the theory advanced, the intent of the word among art experts has changed from period to period. As Viollet-le-Duc says, it is used to mean 'precise relation between the measurements, harmony, moderated relations, calculated, in view of resulting satisfaction for the mind and eyes. . . . Symmetry to-day says, in the language of architects, not a ponderation, harmonious relations of the parts of a whole, but a similarity of the opposed parts, the exact reproduction on the right side of an axis of that on the left.' The Roman architect Vitruvius (1st century A.D.) wrote: As to symmetry it is a proper accord of the members, of works among one another, and of separated parts, the relation of each of the parts with the whole, . . . . Vitruvius defines the Greek *symmetras* as "qualitas eurythmiae." But eurythmy means harmony, just proportion, more precisely "correct rhythm." This is the Greek sense of the word *symmetria*, but the great superiority of Greek over all other art has been claimed to be the artists' subjection to symmetry through the *modulus* used as a yard-stick. On doubt, both in their architecture and sculpture, induces a *system*, for comparative measurements absolutely prove this, but, as Viollet-le-Duc claims, the Greeks had no idea of symmetry as "a kind of decalcomania or counterpart"; theirs was altogether a different idea. It was "a harmony of similarity and dissimilarity of parts." Their symmetry was "a relation between established measurements and adopted rhythm." In architecture of great public edifices in which the Greek classic orders figure there is generally a *centre of symmetry* found, as a bisector from the apex of the pediment of the temple forms, or an axis of symmetry revolving around the centre of the boss above the roof of the choragic monument of Lysikrates, etc. The decorative features must, therefore, in harmony follow the similar restricted spaces framed in the right and left ends by the angles of the pediment, by opposed recurrent figures or other triangular designs. But these Attic artists and sculptors showed a freedom from mathematical preciseness that pleases and rests the eye while leaving an appearance of the closest exactitude to measure. Treated from the aesthetic viewpoint, symmetry of geometrical accuracy in art palls on the senses and, with our modern love of freedom and revolution against art, has given rise to the periods in art fluctuating from the stern lines of classic masters and taking flights into fantastic opposed methods as in the case of the rococo style or the baroque orgy of unfettered freedom and degraded license and symmetry thrown to the winds. Symmetry is imposed on the designer of wall papers; landscapes (at times), and gardens to this day show tendencies to symmetry imitative of Dutch method of treatment of past days. And in interior decor and furniture arrangement we find the idea of symmetry prevalent, chairs and other seats as well as mantle ornaments being in sets. Lovers of unrammed art look to the Far East, and especially Japan, for the breach from symmetry in art. There we find symmetrical arrangement, outside of that necessitated in architecture, altogether absent. In the realm of Occidental painting we find the great masters freely grouping their personages in genre work, though in religious work the main figure (we had almost said the "central figure") is liable to appear in the rather exact middle, and the surrounding figures are apt to be divided about equally on either side, giving
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symmetrical balance, probably a habit formed through the many years in which such depiction was arranged to cover spaces in churches. To such an extent would modern art have a dubious place in art, outside of architecture, according to recent ideas. The asymmetric art methods of the Japanese have produced a powerful reaction in our Western aesthetic taste and the severities of geometric proportion in art design have lost their hold on the minds of this century's artists and patrons. The conception that symmetrical balance smacks of patterns quite popularly prevails and recent schools are revolutionary in accord with the times.

CLEMENT W. COUMBE.

SYMONDS, sim'onz, Arthur, English poet and critic. b. Milford Haven, Wales, 28 Feb. 1865. He has written an Introduction to the Study of Browning (1886); 'Days and Nights' (1888); 'Silhouettes' (1892); 'London Nights' (1895); 'Studies in Two Literatures' (1897); 'The Symbolist Movement in Literature' (1899); 'Collected Poems' (1901); 'Cities of Italy' (1907); 'The Romantic Movement in English Poetry' (1909); 'Knave of Hearts' (1913); 'Figures of Several Centuries' (1915); 'Tragedies' (1916); 'Tristan and Iseult' (1917). He has edited the essays of Leigh Hunt, the plays of Shakespeare, etc.

SYMONDS, George Gardner, American artist: b. Chicago, 1865. He received early training at the Art Institute, Chicago, and at Paris, Munich and London. His work was awarded numerous medals and prizes, and he was elected National Academician in 1900. He has been represented by 'The Quiescent River' in the Metropolitan Museum, New York City; 'Sorrow' in the Cincinnati Museum; 'Snow Clouds' in the Corcoran Gallery, Washington, and 'The Winter Sun' in the Art Institute, Chicago.

SYMPATHETIC STRIKE. See STRIKES AND LOCKOUTS.

SYMPATHY, is in itself feeling felt, and became possible only after human reason began its operations. As feeling, its discussion belongs to psychology; as a sociogenetic power, its consideration is sociological; as a "motive principle of judgment" (Hoffding), it is the concern of the moralist. In any article such as this, it is almost unavoidable to discuss the subject, without at one and the same time involving all three approaches to the consideration of the meaning of sympathy and here no attempt will be made to avoid such a union. As feeling, sympathy is a secondary, it is a representative pain. It is an echo in one's self of the pains of others. Hedonism of all forms makes unconscious conceptions of the subject; and some separation in the brilliancy of individual passages. Other volumes in this general field are 'An Introduction to the Study of Dante' (1872); 'Shakespeare's Prefaces in the English Drama' (1884), an excellent contribution to the history of English literature; lives of Sidney (1887) and Jonson (1887) in the 'English Men of Letters' series, of Michelangelo (1893) and Boccaccio (1895); and English renderings of the 'Novels of Michelangelo and Campanella' (1878) and the 'Autobiography of Benvenuto Cellini' (1888). Others of Symonds' works are 'Studies of the Greek Poets' (1874-75), designed for the popular reader and approaching Hellenic literature through the individuality of the authors; 'Sketches in Italy and Greece' (1874); 'Sketches and Studies in Italy' (1879); 'Essays, Speculative and Descriptive' (1880); 'In the Key of' 'Essay' (1881); 'The Art of Whitmore' (1884); and 'The Books of Memory' (1884); 'Now and Old' (1889), and 'Vagabunduli Libellii: a collection of sonnets' (1881). Symonds' critical work is marked by a finished style and a distinctive note of liberal culture. Consult the 'Life' prepared from correspondence by H. F. Brown (1895); "Herbert Warren's 'Cortwright's History of the Century'; Brooks, V.; 'J. A. Symonds: A Biographical Study' (New York 1914).
ight be an idle speculation to attempt to
in the very earliest form of sympathy.

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er, one may feel certain that it is the
of Herbert Spencer’s idea which is that
by grew out of "Plenty" and "Poverty". It
however, quite probable that "love of the
s" was one of the earliest manifestations
pathy, just as light sometimes is evidence
tricity. Perhaps sympathy was first felt
been increased by the union of her
motive love for her offspring, which
love, though in itself an entirely differ-
ently, early enough blended with or to
create a derivative reason-born sym-
Altruism differs from sympathy in
way. Sympathy is not necessarily a
It is simply a feeling, even though a
depending on the rational process, for
stance. True: it naturally enough suf-
gen. But being a pain, like other pains
desire, it naturally but not neces-
gives rise to a desire to act in such a way
ause relief from pain. As such it is the
of the sociologist. And as said before,
ves an intellectual operation, a knowl-
how one should act to attain an end.
complex, it is sympathetic to which ed desire for activity. It is not only
feeling, it is also motive. David Hume
the passions as an essential part of
nature, in seeking much of sympathy, as
done both by Ferguson and Adam
later by Bentham, and in more recent
by Professor Hofding, each from his
separate point of view. Not a few ethical
sympathy as the parent of all the moral sentiments; and sympathy is a
turn derived from love of kindness.
thy has it seems its seat in the general
al tracts, in the great sympathetic
is, of which there are so many, and of
every wide distribution in the human sys-
t is, however, as yet impossible to
these plexuses, and assign to them
far sentiments — a localization which of
assumes the hypothesis that the system
aimed a sufficient degree of specialization
self a sentiment at all. Altruism, in so
it is not purely biological, is without
rooted in sympathy. This latter, as has
been noted, is not seldom conceived in
as the bases of all morality excepting
orality. One may well believe that with-
pathy all moral reform would be im-
. Just as "Love of the helpless" can:
experienced by a highly rational being,
not (not its blossom), which is sympathy.
doctor of a high rational power of intel-
activity capable not only of representing
the painful states of others, but also of
necing the reflex of such representations
self as a form of pain. For it requires
or bulk, and it is thus difficult for the
other, to represent to one’s self the pains
rs. When once such power is acquired,
is a reflex of the represented pain to self’s reflected pain felt by one representing
not the external stimuli. The reluc-
tude becomes more vivid, he general organization of a human being
more delicate and more refined. Such
gree of differentiation was, one may be
in being attained at an early stage
an development, a fact, which, it may be
mentioned, explains such vicious and abnormal
institutions as the savage subjection of women.
Civilization has been, and may indeed be,
measured by the capacity of men for suffering
representative pain or sympathy and by their
efforts to relieve it. For in the merely animal
kingdom it may be suspected that there is
scarcely any, if there is any, sympathy with
suffering at all. And yet as the fine painting
by Landseer of a 9th Monkeys illustrates,
one may well hesitate to pronounce that feel-
ings of sympathy are entirely alien to the animal
world.

SYMPHONY, an elaborate musical compo-
position for a full orchestra, consisting usually,
like the sonata, of three or four contrasted yet
inwardly related movements, as an andante fol-
lowed by an allegro, another andante varied or
an adagio, a minuet with its trio or a scherzo,
the whole composition closing with a lively
rondo or rapid finale. The symphony, which
may be regarded as the highest kind of musical
composition, was unknown in its present form
before the time of Haydn, who with Mozart,
Mendelssohn and Beethoven are the most suc-
cessful composers of this class of compositions.
The nine symphonies of the latter are gener-
ally recognized as being the noblest works of their
kind. The term symphony is also frequently
applied to short introductory or closing instru-
mental passages in compositions which are
predominantly vocal. See Music; Orchestra.

SYMPTOMOMETER, a kind of barometer
in which the weight of the air is indicated by
the compression of gas in a tube, the lower
part of the tube being filled with some oily fluid
and the gas occupying the upper portion.

SYMPOSIUM, The. In the Symposium
Plato tells the story (in the main fictitious, no
doubt) of a banquet given by Agathon in cele-
boration of a tragic victory on the stage. In-
stead of the usual diversions over their cups
the guests propose to entertain themselves with
successive encomiums of Eros, the god of love;
and of these speeches is formed the bulk
of the dialogue. The most noted section is that
put into the mouth of Aristophanes, the comedian, in which occurs the
humorously worded (not without deep significance)
of the creation of man as a rounded whole,
with four arms, four legs, etc., and of his slic-
ing afterward by Zeus into two half-beings,
male and female, who are driven by love to
endeavor to reunite themselves once again into
a perfect whole. When called upon last, Soc-
rates, with his customary irony, protests his
ignorance, but consents to regale the company
with a tale he pretends to have heard from
a certain wise woman of Mantinea. According
to this prophetess, Eros is the offspring of the
god Poros ("Plenty") and the mortal Penia
("Poverty"); he is thus not properly a god, but
a mighty daemon, or intermediary being, whose
office it is to form a link between the eternal
bounty of heaven and the conscious imperfec-
tion of mankind. Love, the allegory would say,
is not the happiness of the sexes — happiness belongs only to the gods—but the
unsatiated longing to possess. By its creative
power it is man’s substitute for immortality;
for if the individual must perish, yet he is per-
mitted by love to continue his existence in his
children. It is the source of art, leading men
to satisfy by the creation of beautiful forms their innate longing for the absolute beauty that excites them. It is the cause of philosophy. He is not a philosopher, but a god, who knows the truth; nor is he a philosopher who is unaware of his ignorance; rather, the philosopher is he, who, being aware of his ignorance, is driven on ever by the soul's thirst for the truth, to learn and to raise his life into one continual communion with the world of ideas. Whether later in date of composition or not, the 'Symposium' is logically a sequel to the mythological portions of the 'Phaedrus.' In the earlier dialogue Socrates tells how in some remote age the soul of man, in its winged chariot, followed the procession of the gods to the summit of the celestial vault, and from there beheld the everlasting ideas of truth and justice and beauty and the like, of which things true and just and beautiful in this world are the shadowy transient images. And so, when a man sees some fair object or person, love is awakened in his soul as a reminiscence of that half-forgotten vision. In the 'Symposium' the musical nature of love as a reminiscence is less emphasized, but its dynamic and philosophic function is developed in splendid imagery. Without this emotional quality, as it is worked out here and as it is suggested in other dialogues, the ideas of Plato would be a curious theme for the metaphysician; with the introduction of love as the force driving us to participation in their divine nature, the philosophy of Plato is transformed into something that has enthralled poets and artists and entered largely into the rapture of the saints; it has become one of the molding influences of civilization. But it cannot be said that this influence has been entirely for good. From this source has come the popular notion of "Platonic love," which has acted as a befuddling and enervating ferment in society. It is fair to add that Platonic love, as most of the poets have understood it, is the very reverse of what Plato himself had in mind. Petrarch, for instance, would absorb the universe into his passion for a woman; Plato would forget the woman in his pursuit of ideal beauty. It is right to remember also that the conclusion of the 'Symposium' contains the extraordinary confession of Alcibiades, in which, as if Plato was concerned to remove any misunderstanding of his doctrine, Socrates is pictured as the stalwart soldier and as a lover, proof against every seduction of the flesh, a man of iron character above all. Nevertheless Plato's language, when dealing with the passion of beauty, is sometimes unguarded. The 'Symposium' is commonly regarded as Plato's most perfect literary production, as perhaps the most perfect piece of prose composition of any age or in any tongue.

Paul Elmer More

SYMPTOMS, in medicine, the phenomena from which are inferred the existence and nature of disease. Symptoms have their seat in the functions which are affected by the disease, so as to be raised above their usual activity, or depressed below it, or even to be changed in the nature of their action. The organs themselves are often changed in their appearance, structure, size, etc. Symptoms may be perceptible by the patient alone (for example, pain and all change of sensations), or by the physician also (for example, all diseased movements). The nervous, the vascular and the cutaneous systems, for instance, are affected in most diseases; hence also irritability, the power of nutrition, etc., which extend through the whole organization, are so easily affected by diseases, and thus afford symptoms. If the latter are in the organs originally affected they are called idiosyncratic; but if they are caused by sympathy with other and distant parts, they are called consensual or sympathetic. The temperament, age, sex, mode of living, etc., of the patient produce a considerable variety in the symptoms of every disease. When they are indubitable signs of a particular disease, symptoms are called pathognomonic.

SYNAGOGUE. See JEWS AND JUDAISM.

SYNAPTA, a genus of a group of holothurians distinguished by the non-development of an ambulacral system. Locomotion in Synapta is effected by the muscular contractions of the body, aided by the presence in the skin of anchor-shaped spicules of lime, which these animals use to fix one portion of the body, while the other portion is pulled forward. These animals live in muddy coasts and form mud-cases. See Holothuria.

SYNCHRONIZER, an instrument in common use in electric-generating stations employed to indicate the relation between the frequency of two or more alternating current generators and especially to show when a generator is operating at the same frequency as others with which it is the desire of the engineer to connect it, in the same circuit. A variety of the instrument is also employed to determine when the voltages of two circuits are in phase with each other. A common form of the instrument is a small motor the armature of which is connected to one generator and the field-windings to another. By an arrangement of armature coils a rotating field is produced which turns the armature in one direction or the other according to the difference in phase between the circuits. A pointer turned by this shows which generator is fast and which slow. Another form consists of two incandescent lamps connected in the two circuits in such a manner that they light up or remain dark when circuit is closed. Consult Jansky, C. M., 'Electrical Meters' (New York 1912) and Edgcumbe, K. W. E., 'Industrial Electrical Measuring Instruments' (ib. 1908).

SYNCHRONOGRAPH. See TELEGRAPH.

SYNCHRONOUS MOTOR. See ELECTRICAL TERMS.

SYNCLINE. See Fold.

SYNCLINORIUM. See Fold.

SYNCOPE. See FAINT.

SYNCRETISTIC CONTROVERSY. The name given in church history to the disputes which attended prolonged and repeated efforts in the 17th century to bring about the union of all Protestant churches. George Calixtus, pro-
theology at Helmstadt, was the author of an opposition, which was brought forward from 1645 to 1686, when the discussion finally abandoned. See LUTHERANISM.

SYDIC, (1) in government and commerce, officer in various countries entrusted with affairs of a city or other community, of art or trade, etc., who calls meetings, represents, etc. (2) Also a permitted to act in some particular affair he has a common interest with his con-

SYDICALISM, a political and industrial which demands that the means of production and distribution in government shall be open to all those workers who are able and necessary in the community, to many different views on the subject, the belief in cooperation and equality, but a general description is aimed at being antagonistic to every other form of government, whether by government, existing orders or by capital. The motivating force of syndicalism is to form the enthusiasm of the workers. It distrusts organization, delegates arms of leadership except that of the force, Force is the basis of society, weapon is to reform the world. The main aim is to eliminate the present production. The means to accomplish the theories of different exponent doctrine, but they may be generally here. Sabotage, boycotting, strikes and disturbances of all kinds are legitimate, and to avert the possibility of armed force being used to accomplish this, then use their ultimate name. This demands the general strike. This demands the general strike. This demands the action of the entire movement, which, armed, will be compelled to the working class. This having been done, they finally propose to abolish and master; level the reward of all differences of production and education, and trade unions and local organizations. It differs from socialism in that the social revolution through means to abolish capital; whereas the latter to work reform through political means, by gaining majority in existing government. Furthermore, Socialism aims at full participation of the government control and rich unions with capable leaders; syndicalism prefers poor unions and an aura of authority. It differs from the movement in that in its constructive aims at decentralization of trade stead of one tremendous all-embracing organization. The movement began in 1892, when the European were 600,000 avowed Syndicalists. Since it spread to Italy where it was most actively by the agriculturists who at that time were organized and able on the co-operative plan; and the Iway system was under the influence of the movement.

The movement has a large following in England, some 60,000 being present at a conference held before the war. An American similar movement began under the direction of the I. W. W. Russia has many different classes of labor agitators,—the Bolsheviks embody many Syndicalist principles. Traces of it are found also in Spain, Greece and Latin America. Consult Brooks, 'Syndicalism' (1913); MacDonald, 'Syndicalist' (1913); Lewis, A. D., 'Syndicalism and the General Strike' (Boston 1912); Clay, Sir Arthur, 'Syndicalism and Labor' (London 1911); Challaye, F., 'Syndicalisme revolutionnaire et syndicalisme dans l'evolution sociale' (Paris 1908); Harley, J. H., 'Syndicalism and the Labor Unrest' (in the Contemporary Review, March 1912); Kleinlein, Andreas, 'Der Syndikalismus in Deutschland' (Brussels 1912); Lanzillo, A., 'Le movement ouvrier en Italie' (Paris n. d.), and the works of Georges Sorel.

SYNDICATES, a name given in the United States to those combinations of capitalists organized for the purpose of controlling production and raising prices. The term is also used of associations which buy a literary or artistic product outright from the author and market it to subscribers simultaneously in non-contiguous parts of the country. Perhaps the most familiar example of this is the colored SundaySupplements which appear in different journals on the same day at points throughout the continent from the Atlantic to the Pacific.

SYNDROMES, Endocrinous. The conceptions concerning the push that lies behind the metabolism of the human body even in recent years have been all too elementary and simplistic. They have, however, slowly and gradually undergone modification until the importance of a number of overlooked structures have forced themselves within the past 10 years (1910-20) almost with a rush upon the medical horizon. These structures are the endocrine glands or the hormonopoietic system. Their study now constitutes an enormous specialty.

As early as 1838 Parry called attention to the relationship between enlarged thyroid and rapid heart beat, since which time the works of J ohannes Muller, Addison, Gull, Brown-Séquard, Marie and many others have served as starting points for the building up of a rich structure which is amply recorded in a score of monographs. The chief of these are Biedl, 'Internal Secretions' (bibliography of 4,000 titles, 1913); Falta, 'Ductless Glands' (1915); Parhon et Golstein, 'Les Secretions Internes' (1909); Levy and Rothschild, 'Endocrinologie' (1913); Gley, 'Les Secretions Internes' (1914); Sa joux, 'Internal Secretions'; Pende, 'Endocrinologia,' and the special articles in Lewandowski's 'Handbuch der Neurologie' (1913). In addition to these a large number of special monographs upon the individual structures have been written all of which may be found in the works here quoted in the Bibliography.

• Out of this prodigious development, much of which is evanescent and hastily constructed, a large amount of solid substance remains and a number of permanent acquisitions have been made. The net result has been to show much more essentially than ever before the funda-
mental physicochemical foundations of biological metabolic processes as they are utilized in the upkeep of the animal machine. The viewpoint has been advanced that the chemical interrelationships take place between the different organs of the body. That this is automatically regulated through the vegetative nervous system (the old sympathetic) chiefly, apparently in some cases, though this is by no means clear, solely through chemical regulation. The disorders of this adjustment now constitute a special department of vegetative neurology, and are most conveniently grouped under the term endocrinology, or the endocrinopathies.

In the earlier period of the study of these endocrinopathies individual disease groups, uniglandular syndromes, were isolated. Among the most accentuated of these were Addison's disease, diabetes mellitus, myxedema, erythema and acromegaly, but of recent years it has been increasingly emphasized that whereas a certain group of symptoms, which may be linked to plus or minus activities of one or another gland may be at times present, other glandular modifications are bound up in them and are not to be neglected. Hence has arisen the viewpoint that most of the endocrinopathies are, strictly speaking, poly- or pluri-glandular syndromes.

In many years, even back to the earliest days of primitive animistic magic, it has been held that every living tissue yields a chemical product which will act upon other tissues. The early alchemistic studies, those of Paracelsus, to the latter work of Halhmann, and the isotherapists, are all attempts to co-ordinate a host of empirically observed facts. They are all worth rereading if the reader will put himself in sympathy with them through a comprehension of the laws strange symbols then used.

Endocrin glands for the present purposes are those structures which yield products termed hormones and chalone having some definite or specific action related to, yet different from, enzyme activities. These structures are developed from different embryological formations: The hypophysis (posterior lobe) and chromaffin tissues (suprarenal chiefly) are nervous; the thyroid and pituitary (anterior lobe) come from the buccal cavity; the pancreas and mucosa of the small intestine from the branchio, the parathyroids and thymus from the branchial arches (old slit slits of fish); the gonads (testes and ovary) and the intra-renal bodies from the genital ridges. Some of these, in humans, merge into one structure, as thyroid and parathyroid, as chromal and thymus in the suprarenal, as hypophysis (posterior lobe) and pituitary (anterior lobe).

The present article will attempt to sketch only the general outlines of the various uniglandular and pluri-glandular syndromes. The more radical French school is followed, but at the same time attention should be called to the fact that the French school presentations contain some fallacies, and should be read with caution. Still the clinical suggestions of these works are so rich that they need to be a matter of constant to call the attention of the physician to possible relationships rather than to take the more conservative attitude of directing attention only to that which can be indubitably proved. This whole subject is still so empirical that the principle of putting hypotheses to a test will be found to be advantageous than of believing too obviously. The former attitude never gaining useful therapeutic truths, comes monotonous and frequently seems stupidly.

The more recent suggestive and summaries of Biedl, Falta, Laigmel, Levi and Rothschild are therefore maritized.

Uniglandular Syndromes.—Thyroid Myxedema.—The chief symptoms are: development, dwarfism, infantilism, it of skin and mucous membranes, mental slow ideation, defective memory, apathy, slowness, sleepiness, taciturn, iness. The pulse is usually small, rapid, and regular, at times morbidly increased. The constipation, diminished urination, hypo- or hypothyroidism, chininess of the skin. Reflexes dimin The voice is often nasal, slow, monotonous and raucous. Headache is frequent at times epileptic. Other glandular symptoms of diminished secretion.

Exophthalmic Goitre.—A more or less complete catalogue of findings for a lot of case include tachycardia, arrhythmia, anxiety, tions in the neck, exophthalmos, epiphysis Graef's, Stellwag's, Mabius' symptoms, paresis, cramps, tremors, neuralgias, frontal and ocular, colic, hot flashes, sweats, thermophobia, engorgement of dermographism, transitory edemas, palpitation, uticaria, alopecia, diminution of el resistance, albuminuria, polyuria or glycosuria, bulimia, vomiting, ptyalism, chlorhydria, diarrhea, dyspepsia, atrophy of mammary, loss of flesh, emotional instability, volubility, in- anxiety, excessive anger or reverse, excitement, marked depression, cyclic variations, confusion, epileptic attacks finger and Hess have endeavored to a vagotonic and sympathicotonic type.

In the vagotonic type the more pre signs are decreased lacrimation, less e mos, with enlargement of the parotid v. Graef's sign, abundant sweating, mild tachycardia, no alimentary glycopenia and oculocardiac reflexes possible. The sympathicotonic types there are cases. Dryness of eyes, violent tactile glycosuria, oculocardiac reflex reversed sent, increased reaction to adrenalin. cases are mixed in type. In all save infants psychical influence are strict psychotherapy is extremely valuable in stages, less so in chronic cases. Mor bulk large in the etiology of the psy cases.

Thyroid insufficiencies, other than myxedema, are infantilism, obesity, syndromes, pseudolipomatosi s, alopecia, pre loss of hair, celeroderma, urticaria, prur itu reigning herps, transitory edemas, in a vasm, coaptation, mucous enter dactylopathy, acne, erythema, rhinorrhea, glucose toler ance, chilliness, mammary h.

Thyroid Instability (Levi and Rot From dyshypothyroidism: chilliness, b
depression, crying, giddiness, passing
neuralgic pains, suffocations, shivering,
et al menstrual period. With pre-
dysthyroidism: the following symp-
ms: tear secretion, hot flashes, a
intestinal spasms, irritability, emo-
phobias, inquietudes, migraine, asthma,
asis dysdiastasis, tremors. Mixed cases:
shivering, migraine, frequent urin-
ation, pain, reddening of
, catamenia; neuralgia, anxiety, dilata-
tion of visceral, swelling of feet, varia-
volume of the feet, tremors, nervous
sterical attacks.

byroid.—Tetany.—This syndrome is
ably related to parathyroid loss or de-
akinson's syndrome(?). The view
Lundborg and of Gauthier is that this
belongs here, and is a hyperfunction
but it rests on very unstable founda-
ms.—Vagotonic Symptoms of Basedow
(?): Profuse sweating, palpitation,
osis, eosinophilia, sensation of weak-
thenia of Erb-Goldflam (?): Headache,
ternal ophthalmoplegia, fixed or transi-
tis principally of the face, the neck, ic
ic electrical reaction.
: Loss: Idiocy of Klose and Vogt.
?: Basch.
renals.—Addison's Syndrome and Sup-
sufficiency: Asthenia, arterial hyperten-
sion, nausea and vomiting, lumbar
lanoderma, white lines on the skin,
ny, abulia, depression. At times
ic, epileptic attacks, tetany, periodic delirium, mental confusion, sudden
renal-genital Syndrome: External femi-
udo-hermaproditism with virile sec-
osexual characters; suprarenal virilism;
hea, gynecostasy, adiposis with easy
all signs of feminine maturity; hy-
y of the clitoris, hypertrichosis of e
type, masculine voice, muscular and
hypertension, active and violent sexual
; arterial hypertension, arteriosclerosis.
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olar plexus, aortic parangion of andi,
cardiac parangion of Wiesel
ner, Luschka's carotid and coccygeal
tympanic parangalia. The syndrome
ctions of these glands is entirely
reas.—Diabetes Mellitus: Glycosuria,
polyphagia, polydipsia; neuralgias,
impotency, constipation, dry mouth,
diminished perspiration, atrophy of
icles, abolition of the tendon reflexes,
hypertension, asthenia, headache, sus-
y to cold, perforating ulcer of the foot,
s, comatose or apoplectic attacks,
, vertigos, asthmatic dyspnea, pseudo-
marcolysis, depression, apathy, hypo-
and coma.
ophys.—Froehlich's Genital Adiposity
ne: Adiposity, arrest of development or
of the genital glands, of the genital
nd the corresponding secondary sexual
smolence.
rome of Hypophyseal Insufficiency of
Renon and Delille: Tachycardia, instability of
the pulse, arterial hypotension, insomnia, an-
orexia, distressing sensation of heat, exaggera-
tion of sweat secretion in
eyebrow development, hot flashes, a
intestinal spasms, irritability, emo-
phobias, inquietudes, migraine, asthma,
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nd the corresponding secondary sexual
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Synergism — Syngye

Surnareal Predominance.—Addisonian with

amnenorrhoea, impotence, chilliness, tetany or, on

the other hand, exophthalmic goitre.

Very often Baseadovian, acromegalics,

giants, with spontaneous glycousia, alimentary

or merely adrenal, the latter making it possible

in certain cases to suppose a certain degree of

suprarenal hyperactivity.

Without Marked Predominance.—The case

of Claude and Gougerot is an example: Loss

of sexual characters, countenance old-looking

skin thickened, wrinkled, pigmented; chilliness;

absence of perspiration, asthenia, arterial hypo-

tension, tetany; resticcular, prostatic, suprarenal,

thyroidal and perhaps parathyroidal atrophy.

Consult Jalilhe and White, 'Diseases of the

Nervous System' (3d ed., 1919; chap. III, 'The

Endocrinopathies')

Smith Ely Jelliffe, M.D.

Synergism, the co-operation of man

with God in the act of his conversion; the term

was first employed to designate the relation of

man to the Holy Spirit in the work of conver-

sion, as defined by Melanchthon in the 'Let-

terum' (1548). Luther, in his commentary on

Genesis, allows to man no part whatever in this act: "In things spiritual and divine which

are to the salvation of the soul, man is like

the pillar of salt into which Lot's wife was

transformed; nay he is like to a block and a

stone, a lifeless statue which has no use of

eyes, mouth, of any of the senses, or of the

heart." Melanchthon's doctrine (which, how-

ever, he soon retracted) was that "God does

not deal with man as with a block, but draws

him so that his will co-operates"; it was a

term of co-operation that gave to Melan-

cthon's doctrine the title Synergism.


studied in Alexandria, where he was the friend

and pupil of Hypatia (q.v.). In 409 he was

baptized in the Christian Church and the fol-

lowing year consecrated bishop of Ptolemisii

in North Africa. He published his philosophical

works and completed his religious writings, in

his works: homilies, letters, hymns and other

literary works. In these exhibits multitudinous learning, keenness of

intellect and a glowing style. The Christian

domains which seem to conflict with his philo-

sophical views he explains allegorically.

Consul

Migne, 'Patrologia Graecae' (Vol. 66, 1859);

Volkmann, 'Synesius von Kyrene' (1869);

Crawford, W. S., 'Synesius the Hellenic' (Lon-

don 1891); Gardner, A., 'Synesius of Cyrene'

(lib. 1886).

Synge, sing. John Millington, Irish

dramatist: b. Newtown Lillie, near Rath-

farnham, 1871; d. 24 March 1909. He received

his education at Trinity College, Dublin, where

he was graduated in 1892. For about seven

years he studied music in Germany and

languages in Germany, Italy and France. He

spent several years in the Latin Quarter of

Paris where he gave his attention to the study

of decadent French literature, especially to

Baudelaire. He accomplished little in Paris but

being meanwhile interested in London, in 1897

William Butler Yeats persuaded him to aban-

don his efforts as a French literary critic and

study the social types, manners and customs of

the inhabitants of the Aran Islands, a people

ing to Relbauts and Gravier are: (a) The

sterile, (b) Emaciated gigantism, because the

internal pressure of the organ is established

late. In this case there is a prolonged infantil-

ism. (c) Emacium with castration charac-

terized by gigantism and infantile appearance.

The secondary sexual characters do not appear.

(d) The reversion infantilism of Gandy, where

simply a sort of asexual condition is noticed,

with attenuation of secondary sexual characters

and a certain degree of obesity, with late testic-

ular difficulty in the adult.

Dishyperdestiasis: Lower limbs short and

cranium very large, pilous system well de-

veloped, especially the mustache, thinness,

persestence of youth, a degree of arterial hyper-

tension, virile character, activity, moral and

physical energy.

Prostate.—Prostatic Insufficiency: Asthenia,

diminution of potency, neurasthenia, at times

suicide.

Hypertrrophy of Prostate: Arterial hyper-

tension, retardation of the heart, cerebral

hemorrhages, genital excitation.

Pluriglandular Syndromes.—Basedow's
disease with thyric hypertrophy and vagotonic

symptoms; scleroderma and tetany, ameno-

rhea; Addison's syndrome; acromegaly, etc.

Myxedematous with Thyric Hypertrophy.

Tetany, acromegaly, Addison's syndrome,

amnenorrhoea, infantilism, mammary hypertro-

phy, etc.

Acromegalic or ovarian insufficiencies with

various disturbances, psychic, nervous, vasomotor, trophic, etc., connected at one time with

the myxedematous, at another with the Base-

adowian series.

Ovarian Predominance.—Thyroid Reaction

to Ovarian Insufficiency: Tachycardia, palpita-

tions, perspirations, nervous irritability, vertigo,

shy lesion, trembling, anxiety, etc.

The differences between these nervous man-

ifestations and the picture of the attenuated

forms of exophthalmic goitre are very slight,

says Leigl-Lavaste. This pathogenic con-

ception permits of important therapeutic results;

one may ask, for example, whether the anti-

Basedowian therapy with hematothyroidin

would not be of advantage in the nervous and

psychic disturbances of the normal menopause

which repeat one feature after another of the

Basedowian series.

Dyshpersion of the Hypothyroid: Antici-
pation, prolongation and copiousness of

the menses, menorrhagia, metrorrhagia.

Thyro-ovarian Disturbances of the Same

Significance: Either ovarian insufficiency in

the myxedematous series, or the dyshyper-

ovarian in the Basedowian series; in either case the

nervous disturbances of the dysthyroid are

modified by all the factors of the ovarian

rhythm, whatever they may be.

Hyperthyroid Predominance.—Infantile

vitality, with their clinical varieties: feminism,

 comunism, cryptocardism, feminine pseudo-

hermaphroditism, mental infantilism.

Acromegalics with deficiency syndromes,

myxema, infantilism, amnenorrhoea, obesity,

et alia.

Acromegalics with syndromes of hyperactiv-

ity, more or less vicious, synergetic or substitu-

tive, simple or exophthalmic goitre, arterial

hypertension and atheroma, lacteal secretion
SYNGENETIC.—SYNODICAL PERIOD

I retained their primitive Celtic culture. They settled in Dublin where he became a literary advisor to the Abbey Theatre where he produced his dramas. These have been poems and plays which they “provoked” when produced in 1 and in the United States. His first play, “In the Shadow of the Glen” (1903), was followed by “Riders to the Sea” (1912). He was a pioneer writer in Irish literature, especially in prose. His novel, “The Tinker’s Daughter,” although written in 1902, was not published until 1909. The next significant event in his career was the publication of “The Will of the People,” a play about a peasant revolt in the West of Ireland, in 1906. In 1907, he published “The Play of the Western Riders” in Irish. This play, along with several others, established him as a prominent figure in Irish literature.

SYNGNATHIDÆ. See PIPER-FISHES.

SYNNÖVE SOLBAKKEN, sin’ê-vê’ sôl-bäk’ken, a peasant-romance by Björnstjerne Björnson, was published in 1857. Although this was not the first appearance of a work by Björnson, it was one of his most popular and influential. The story is set in Norway and concerns the life of a peasant family during the Middle Ages. The main characters are the peasant girl Synnöve and her lover, Peter. The story is filled with descriptions of the peasants’ lives and their struggles against poverty and ignorance.

SYNOD, an ecclesiastical deliberative and legislative assembly. The word is synonymous with council, but ecclesiastical assemblies are commonly called councils and minor ecclesiastical assemblies synods, though these are also styled councils. A diocesan synod is composed of a bishop and the clergy of a diocese; a provincial synod, of an archbishop (or metropolitan) and the bishops suffragan to him; a national synod of all the metropolitans and bishops of a nation. In the Presbyterian Church, synods are courts of review immediately superior to the presbyteries and consist of all the ministers and elders who are members of a number of contiguous presbyteries; the supreme council of the Presbyterian Church is the General Assembly.

SYNODICAL PERIOD, is the period between two successive conjunctions or oppositions of a planet with the sun, as observed from the earth. A synodical month is a lunation, being the period from full moon to next full moon.
SYNONYMS — SYNTHESIS, CHEMICAL

full moon or from new moon to next new moon. A synodical month is 29 days, 12 hours, 44 minutes, 2.37 seconds.

SYNONYMS, words of the same language which are the precise equivalents of each other; in popular acceptance, words sufficiently alike in general signification to be liable to be confounded, but yet so different as to require to be distinguished are synonyms. The following pairs of words are pairs of synonyms: teacher, instructor; resemblance, similarity; supposition, hypothesis; beginning, commencement. But words commonly regarded as synonymous are seldom perfectly so, as is seen in works on synonyms. There is always going on in a language a process of "desynonymization" which tends to restrict one member of a synonynous pair to one meaning, the other to another. For example, "wave" and "sillow" originally meant precisely the same thing; but "sillow" is now restricted to poetical use, while "wave" is used chiefly in practical matters. The study of synonyms is a valuable intellectual discipline in itself, apart from consideration of its high importance as a guide to the right use of words. The habit of thorough investigation into the meaning of words, and of exact discrimination in the use of them, is indispensable to precision and accuracy of thought, and it is surprising how soon the process becomes spontaneous, so that one often finds himself making nice and yet sound distinctions between particular words which he has never made the subject of critical analysis.

Consult Crabbe, George, "English Synonyms" (new ed., New York 1911); Fernald, "English Synonyms and Antonyms" (ib. 1896); Ordway, E. B., "Synonyms and Antonyms" (ib. 1913); Roget, P. M., "Thesaurus of English Words" (new ed., ib. 1914); Smith, C. J., "Synonyms Discriminated" (3d ed., 1885).

SYNOPSIS GOSPELS, those called of Matthew, Mark and Luke, which regard events generally from the same point of view and present strong resemblance to each other. Four hypotheses have been offered to account for the correspondence of the synoptics: (1) Derivation from some common written original. (2) Priority of one of the three and recurrence to that by the authors of the other two. (3) Derivation of all three from the same source independent of tradition. (4) Derivation of all three from the oral tradition, but consultation of Matthew's gospel by Mark; of Matthew and Mark by Luke. See BIBLE.

SYNOVIAL MEMBRANE, the membrane lining the various joints or articulations and which secretes a peculiar fluid — the synovial fluid — for the lubrication of the joint. See JOINT; MEMBRANE; ARTICULAR.

SYNOVITIS. See ARTICULAR; JOINTS.

SYNTAX. In grammar, proper arrangement of words under established rules and according to the best usage in order to express ideas. A word expresses a single notion, but language has more than an animal sound meaning, like the cries of animals, a wish or a feeling. A combination of such sounds, properly arranged and connected for the expression of ideas, becomes language. The art of constructing sentences is literature, not less important than the power of speech; it is indeed the intellectual part of language and a characteristic of reason. The first step in syntax is the analysis of sentences; a clear mutual relations of the several members of a sentence makes the usual rules of syntax appear self-evident truths and in most cases superfluous. See GRAMMAR; PHILOLOGY.

SYNTHESIS (Lat. synthesis, from Syn + thesis, combination, composition), the combination of individual objects or elements of thought into a whole. Thus, by synthesis separate propositions are combined into a system, or simple concepts into compound and complex ones. In this manner one recognizes that various properties, taken together, constitute the characteristics of some one object. The process, however, does not destroy the identity of the component parts, but merely correlates them into a unity. It is, therefore, the opposite, or complement, of analysis (q.v.), which is the process of distinguishing within some given object the various characteristics of that object, without, however, destroying its unity. Hence the name synthesis is applied in mathematics and philosophy to a process of reasoning working to a conclusion from propositions that have already been demonstrated, or principles that have previously been assumed or established.

SYNTHESIS, Chemical. The building up or formation of chemical compounds from their elements or groups of their elements. The opposite of analysis, one meaning of which is the breaking up or decomposition of a chemical compound into its elements. Thus the formation of water from its elements hydrogen and oxygen is synthesis, while the decomposition of water into hydrogen and oxygen is analysis. Many of the most important manufacturing processes are synthetical. The synthesis of compounds from their individual elements is of great scientific but of little technical interest. However, the recent synthetical process of unifying moist nitrogen and oxygen to form nitric acid by use of the electrical discharge bids fair to be of great interest to mankind because of the use of nitrates as fertilizers. The synthesis of compounds from groups of their elements is of very great industrial importance. Sometimes only a single and simple chemical reaction is required, as, for example, the action of water on quicklime to form slaked lime, while others, such as the manufacture of indigo from naphthalene, require many and complicated changes. There is a great difference as to the ease with which elements or groups of elements unite to form compounds. Some unite readily under ordinary atmospheric conditions of temperature and pressure, while others may require the action of heat, light, electricity, presence of water, etc. Phosphorus and iodine unite the moment they come in contact. Phosphorus and oxygen unite slowly at ordinary temperatures but with violence if the temperature is raised; sulphur and iron do not act at all in room temperature but do so when heated; hydrogen and chlorine do not act in the dark at ordinary temperatures but do so with explosive violence if exposed to the light; ammonia and hydrochloric acid or the mixture of tartrate or soda and cream of tartar used in baking powder do not react when dry but do so in the presence of water.
SYphilis

tically supreme for more than three centuries and was not definitely overthrown until 1838. At the present time we pre-

t the laboratory by synthetical processes. Aion of a "vital principle" or "vital force" ought to be necessary. Wöhler showed be not true when (1828) he prepared organic substance produced by animals, microorganism cyanate. Since that time an e number of other organic substances been prepared by synthetic processes. f the well-known ones are oil of winter-

indigo, caffeine, alizarin, etc. The pro-

ised in synthesis have been so thoroughly that the chemist has only to find out the hemical structure of a compound to be prepare it in the laboratory. Sometimes batory processes are too costly to be nical importance, but often they are of ommercial value. See INNGO; ALIZARIN.

y substances are prepared by synthesis ver existed in any plant or animal. They cly laboratory products. To this class most dyestuffs, many valuable medicines among them quinine, are contributions of es. Consult Berthelot, P. E. M., 'La e chimique' (Paris 1876); Posner, The-

ehrbuch der synthetischen Methoden g 1903); Lassar-Cohn, 'Arbeitsmethoden der Chemische Laboratorien' (2 vols., rg 1907).

PHILIS. This is a general infectious n chronic in character, which may be nicated through inculcative contact or itted by inheritance. In the acquired t first produces at the point of inocula-
specific ulcer caused in the character, fol-

by a gradual infection through the com-

ating lymphatic vessels and eruptions the skin and mucous membranes. Later, develop in the connective tissue, or in rt of the body, adventitious new growths may undergo suppurative or destructive s.

history of syphilis is shrouded in ty; certain writers have sought to trace it back to a remote antiquity. It is f syphilis was well known to the s, and that descriptions of morbid con-

applying to this disease are found in the Egyptian papyri, Assyrian and Baby-

scriptions, as well as in the ancient z and Japanese literature and the books Vedas. The evidence which connects v these ancient historic records is indefinite and inconclusive. Our actual ge of syphilis dates from the appear-

f the disease in Europe about the year and there is much evidence to show that ease was native in South America and ought to Europe by Columbus' sailors. can be no question that gonorrhea and e affections of the genital organs re-

from sexual debauch and uncleanness well known and frequently spoken of by writers. With the eruption of syphilis ppe toward the close of the 15th century, widespread extension, the identity of haw number of eyes in substantia i the appearance of this newer and more formidable

During a long period all diseases of vital organs were regarded as identical in and nature. This doctrine reigned prac-
SYPHILIS

SYPHILIS. After the second incubation the disease is said to become constitutional, although it is not definitely known at what precise time generalization of the virus takes place. Not infrequently there is, during this period, some evidence of constitutional disturbance—headache, neuralgia and febrile disturbance, more or less pronounced—which usher in what are recognized as the constitutional signs of syphilis, in the shape of eruptions upon the cutaneous surface or the mucous membranes.

The secondary stage occurs usually from 18 months to two and a half years in duration. The secondary eruptions are not continuously present, but come out in successive crops. The completion of this stage may mark the definite end of the disease, or there may succeed the tertiary stage, characterized by the appearance of gummatous formations which may affect the sub-cutaneous tissues, the periosteum, the bones and the internal organs of the body. The duration of this stage is practically indefinite. The tertiary lesions may continue to recur for 5, 10 or 15 years, or even during the lifetime of the individual. This division of syphilis into stages is somewhat artificial. It does not always pursue this regular and methodical course, with an early formation of secondary and tertiary lesions; there is not always a sharp limitation between the stages. Secondary manifestations may continue to recur for several years.

Syphilis, as we comprehend it to-day, has a much greater significance in its relation to the health of the individual than was formerly supposed. Our conception of the range of its pathological action has been gradually enlarged with increasing knowledge of the vast complexity and far-reaching character of its mutilating processes. While it was formerly known that syphilis was a constitutional disease and capable of causing changes in the internal organs, these systemic complications were regarded as few in number and of only occasional occurrence. The sporadic manifestations which took place upon the surface of the body were thought to constitute practically the entire expression of the disease. At the present day, secondary manifestations are regarded as of subsidiary importance, since they rarely compromise the integrity of any important organ. The tertiary manifestations of the disease—cerebral, spinal, vascular, ocular, pulmonary, intestinal, hepatic and renal affections—constitute the chief significance, as well as the individual danger, of the disease. The tertiary lesions of the brain and cord occupy the first rank in frequency as well as in gravity. Of all the menaces to the life and health of the individual from syphilis, lesions of the nerve centres are the most to be feared. The pathological field of syphilis has been greatly extended by the inclusion of a group of affections, badly termed parasyphilic, which, though of syphilitic origin and nature, are extremely refractory to specific treatment and practically ineradicable. As types of this group, certain diseases may be mentioned: locomotor ataxia and general paralysis. It has been stated that every hemiplegia occurring in middle age addicted to alcohol or affected with lesions of the circulatory system is, in nine cases out of 10, of syphilitic character. Practically all cases of paresis and tabes dorsalis are due to syphilis, and the spirochete has been found in the brain spinal cord in these diseases.

Syphilitic Heredity.—From a strictly sociological standpoint, the hereditary consequences of syphilis are of the greatest significance. Its prevalence and incidence give to syphilis an especial importance as a factor in the degeneration and depopulation of the race. Syphilis is recognized as the perfect type of a hereditary disease. No other disease is so susceptible to hereditary transmission, so pronounced in its influence, and so destructive to the offspring. The hereditary influence of most other diseases is manifest in the transmission to the offspring of a constitutional protoplasmic state, characterized by a feeble organization and diminished resistance to disease. In tuberculosis and leprosy, for example, the influence of heredity is limited to the creation of a predisposition to disease, from an enfeebled capacity of resistance of the organism, which renders it readily susceptible to the action of the germs of disease. In syphilis, there is a direct transmission of the specific qualities contained in the sperm or seminal cells, with the result that the normal process of nutrition are vitiated and the production conception is impeded in its development or is destroyed. No disease has such a murder influence upon the offspring as syphilis.

Syphilis may be transmitted by indirect heritance through the specifically infected sperm or ovule at the time of impregnation or from the utero-placental circulation in the course of pregnancy. Post-conceptional syphilis is applied to cases where the mother—or even both parents—may be healthy at the date of conception, the wife is infected during the course of her pregnancy and she in turn transmits the disease to the child in utero through the vascular channel of the utero-placental circulation.

Syphilis may be transmitted directly from the father, the mother remaining healthy, though in most cases the mother is infected by the fetus in utero. It may be transmitted directly by the mother, the father being healthy. The paternal hereditary influence is actively restricted; the influence of maternal heredity is much more certain and pronounced. When both parents are syphilitic, the child is almost inevitable—especially when the disease of the parents is recent and active. The percentage of deaths from mixed heredity varies from 60 per cent to 86 per cent. The quality of hereditary transmissibility is not impressed upon the syphilitic organism permanently. As the disease grows older there is a progressive enfeeblement of the transmissible power, until it finally becomes extinct. Influence of heredity is rarely manifest in the fourth year; still, there are many authenticated cases in which it may be shown over a period even longer. The attenuating influence of time upon syphilitic heredity is shown in a series of successive pregnancies. The first pregnancies terminate in abortion, which occur at a later and later period; then, still-born children, or children bearing at birth but which die soon; then, syphilitic children, surviving but showing evidences of specific taint; and, finally, healthy children, free from all signs of the paternal disease. Specific treatment also exercises a powerful corrective
SYPHILIS

* upon heredity. It frequently happens syphilitic parents undergo active treat-
* the time of pro-creation the child
* next pregnancy may result in a
* Treatment seems, then, not to
* transmission capacity.

* Syphilis. — Death of the child in
* the most habitual expression of heredi-
* al child has escaped. It is now known
* if the syphilitic child has escaped the
* manifestations of the disease it may be
* that afflict modern syphilis, are especially liable to appear at the
* period of pu-
* en a child the subject of inherited syph-
* born alive it may be apparently healthy
* very often lesions of the osseous system
* manner. After a certain period, usually
* a few weeks or months, the child may
* the stigmata of the parental dis-
* The surface manifestations of inherited
* like those of the secondary stage of
* are at first generalized and
* Later, they become more discrete, with
* Lesions of the internal organs often co-
* the earliest cutaneous manifestations.
* tary syphilis is further differentiated
* the acquired form by certain lesions
* are its exclusive products. They are not
* of changes impressed upon the fetus in
* they are the characters of dystrophies or de-
* due to perversions of nutritive
* dystrophies may affect the entire body
* limited to a single organ or a system of

* influence of hereditary syphilis is often
* in a native debility or inherent inca-
* for life. Many syphilitic children are
* with a feeble vitality, so that they
* to slight causes of disease. They die
* age, often with no obvious signs of
* but simply from an inability to support
* They are the subjects of what may be
* sudden, inexplicable death.*
* another class of cases there is an arrest-
* ration of development; the children are
* or dwarfed; they develop slowly
* and mental; they are prone to nervous
* or idiotic. The term "infantilism* has
*ployed to express the sum total of these
* in other cases there are pre-

* anomalies or marked deviations from
* double, the bones of
* the cranium and in the long bones, producing
* malformations of varied types, such as incurva-
* tion of the tibia, pronation of the thorax, curved spine, deformed pelvis, etc.
* these dystrophies may be expressed in such
* marked deviation from the normal type that
* the result is a monstrosity.

* Syphilis as a Social Danger.— It is now
generally recognized that syphilis, with alcohol-
* and tuberculosis, are the three great plagues
* of our time. Owing to its wide prevalence and the dangers to the per-
* sonal health and life of the individuals affected, syphilis constitutes a serious menace to the pub-
* lic health. The amount of morbidity from this
cause in any country or community is an un-
* known and unknowable quantity, since owing to its secret and shameful character cases of
* this disease are not subject to official registrat-
* the spread of syphilis is favored not only
* the fact that its contagious activity and
* transmissive power persist during a prolonged
* period but because it is exceedingly prolific in
* its sources and modes of contagion. While it
* is commonly propagated through sexual rela-
* tions, syphilis is not necessarily so contracted.
* It may be conveyed by accidental inoculations,
* in the ordinary relations of life, in various
* industrial and professional occupations. Kiss-
* ing is a very common mode of infection and a
* very large number of cases of contagion occur
* in this way. A syphilitic infant may infect a
* healthy nurse, or a healthy infant may receive
* infection from a syphilitic nurse in the act of
* suckling. Syphilis may be transmitted through
* the intermediary of any object upon which
* the secretions of the syphilitic have been acciden-
* tally deposited. It may be conveyed in wash-
* ing vessels, spoons, knives and forks, household
* effects, pipes, toilet articles and other objects
* too numerous to mention. Certain occupations
* favor the spread of syphilis, especially that of
* glass blowing, where the infected blow-pipe is
* passed from mouth to mouth. Syphilis is not
* infrequently communicated in barber shops,
* through razor wounds or through the use of
* shaving brushes, soap or towels. Infections in
* professional life are not uncommon. Physicians
* and accoucheurs have acquired syphilis in the
* examination and treatment of syphilitic
* patients. Every syphilitic individual is the
* source of possible danger to persons with whom
* he comes in intimate contact. A case of syph-
* ilis in a family may be the origin of many in-
* cent infections. The syphilitic child may infect
* the nurse and members of the family; these in-
* turn may affect others. Veritable endemics of
* syphilis, amounting to 10, 15, 20 or more in-
* fections, have originated in this way. It is this
quality of expansiveness, this capacity of morbid irritation through family and social life, that gives syphilis its superior significance as a social danger.

It is especially, however, in its relation with marriage that the ravages of syphilis as a social plague are of the highest interest and importance. By its inhibitory influence upon the productive energy of the family, syphilis may seriously compromise or entirely defeat the social aim of marriage—the raising of children. When it does not destroy the product of conception, it may blight its normal development. The subjects of inherited syphilis that survive are stamped with inferiority and compelled to pass through life bearing the stigma of degeneration or disease. A syphilitic man should not marry so long as he is capable of carrying contagion to his wife or begetting syphilitic children. Since the contagious and transmissive power of the disease is gradually exhausted, syphilis constitutes only a temporary barrier to marriage, which may be removed by time and treatment. It may be formulated as a general maxim that a man should not marry until after a certain period (on an average four years) has elapsed since the date of his infection, during which time he should receive sufficient specific treatment. A still longer period of probation would afford an additional guarantee of safety. It is to be observed, however, that there may be contra-indications to marriage which arise from risks to the personal health of the individual by reason of his disease. The syphilitic man may be exposed to dangers, the consequences from his disease, which unfit him for the responsible position of head and support of a family. The possible existence of such disqualifying conditions must always be taken into consideration when the question of marriage is concerned.

Diagnosis.—The chancre or indurated ulcer which appears upon that portion of the body where inoculation has taken place, which may be at any point where the skin or mucous membrane has been broken or injured, has been regarded since the time of John Hunter as the distinguishing evidence that syphilis is present. The discharge or secretion from such a sore, as well as the blood of the individual who has the sore, both of which contain the germs of the disease, may be examined to determine whether the disease is communicated, while the period during which such communication is possible may continue through several years if the disease remains untreated. These germs produce a specific antigen, by their action upon the blood and tissues, and this forms the basis for the Wassermann test in the diagnosis of syphilis. This test works upon the theory of deviation of the complement by antigen substances contained in the syphilitic blood, blood or cerebrospinal fluid, and prevents or fails to prevent the lytic action of the hemolyzing fluid, according as syphilis is present or absent.

The Wassermann test is made in the following manner. Certain definite quantities of tissue fluid are taken from the liver and spleen of a syphilitic fetus, together with a definite volume of the blood serum of the individual upon whom the test is to be made. They are mixed in a test tube and fresh normal guinea-pig serum which contains the complement is added to the tube is then placed in an incubator, temperature of the body, for one hour which its contents are poured into a tube which contains a mixture of red cells of a sheep, or other suitable animal, in a physiological salt solution, serum of a rabbit which has been immunized beforehand with red blood cells of sheep. If the individual whose serum was placed in the first test tube actually has there will be no hemolysis of the red cells in the second tube after it has been in the incubator for the required period of time. In other words there will be no fixation of the reaction is said to have occurred. If, on the other hand, hemolysis does take place the result is negative and the individual presumptively not have syphilis, or has it in a quiescent condition. Various errors may occur. The Wassermann test, so that it is not absolutely reliable. This has resulted in the development of various modifications of test, one of which is known as the Quincke modification. The Wassermann test or the Quincke modification must be repeated at intervals of a month or two for a year or more; even it should be negative on each occasion to determine whether the disease has been eradicated.

Treatment.—Mercury and the potassium have until a very recent date been the basis of most of the successful treatment of syphilis. A great deal of enthusiasm was recently shown for the results of the salvarsan or "606" results which have been obtained by extending experience. While there is little question of the incontestable efficacy of this in causing the earlier lesions of syphilis to disappear, and even certain intractable of a later stage, yet relapses are the more common, it would appear, the use of mercury. The effect of a special treatment in preventing the dreaded manifestation of disease upon the nervous system and the essential to life is the crucial test of active value. It will be necessary for many years before we can estimate its curative value. The Wassermann test is essential in determining whether any chronic infectious disease of the nervous system is present or not.

SYR, or SIR DARYA, sēr-daˈr̩yə k’estan, (1) A river (the ancient Jaxartes) rising in the Taken from the river and flowing from the Two regions boundary of East Turkestan and southwest into the Aral Sea. It the districts of Ferchana, Samarkand and Bokhara and has a total length of 1,400 miles. In its upper course it receives
Syracuse. After leaving the mountain regions of rapid streams it flows for the rest of its course over the vast arid plains of the Syr area but receives few affluents. It here edly divides itself and numerous irriga- canals lead from it into the surrounding y. The river is navigable for 600 miles, a proposed line of steamers has not yet been installed. (2) A district of Turkestan an area of 194,853 square miles. The is Tashkend; pop. about 150,000. The tion of the district is 1,990,000.

RA, sērā, Greece, (1) An island in the Sea, the largest of the Cyclades, 13 south of Andros, with an area of about 10,000 square miles. The surface is rugged and the coast indented by numerous bays. The diversified landscape includes valleys with some barren patches. The products are wheat, barley, cotton, wine, and crops are inadequate to the needs of the population. The imports are largely composed of provisions such as flour, tobacco, sponges, valonia, etc. abut 20,000.

RACUSE, sīr-a-kūs, N. Y., city and city of Onondaga County, situated on New York Central and Western railroads, almost ex midway between Albany and Buffalo, 148 either way, in lat. 43° 9' W. The New York State Barge Canal reaches it through the Lake. Topography.—The city is at the foot of the aga Valley, through which and the city the aga Creek flows into a lake of the same name, the city, five miles long and one wide. The southern part is 1 by hills at the northern end of the lake on the east and west of the valley and considerable distance southward; the northern part is upon ground which the northward from the Erie Canal to the r boundary. There are several hills of e formation and of geological interest. iderable part of the city is situated upon ight down from the Onondaga Valley, th at point of at least 179 feet, as will the depth of a salt drill passed ha cedar log. Perhaps there is no sec the State of New York which possesses of geological interest than Syracuse and a County, and this is certainly true of +

Transportation.—Syracuse is an important railroad point, its roads being to its centre the spokes of a wheel to the hub. Passenger trains to the number of 100 arrive in and depart from the city daily. Abundant freight facilities are offered by competing lines and important advantages can also be had from the improved New York State waterways. Diverging from the state banking railroads: New York Central, West Shore, and Delaware, Lackawanna and Western. These roads not only thread some 20 counties in central New York, but several of them extend, with their connections, to the extremes of east, west, north and south. Of street railways, the trolley system embraces 95.72 miles of single track. This includes the mileage of track within the city of Syracuse, also to East Syracuse and Minoa, Eastwood, Liverpool, Solvay and Rockwell Springs. The New York State Railways operate to Utica and intermediate points; the Empire United Railways to Oswego and intermediate points; the Rochester and Syracuse to Rochester and points beyond, such as Buffalo and Lockport. All these lines carry freight and express. Pop. 25,000. The trolley lines operate from Syracuse to Utica, Watertown, Oswego, Auburn, Cortland and Rochester.

Commerce and Industry.—Syracuse ranks fourth among the cities of the State in the number and variety of its manufacturing plants; there are 700 industrial establishments, with an approximate investment of $63,957,000, and an annual production valued at $52,236,000, employing 25,000 persons. The manufacture of typewriting machines has taken on large proportions, the combined interests representing at least $8,000,000 in plant and equipment. The product is large and constantly increasing. Automobiles are produced in large numbers, and among other manufactured articles are soda ash, tool steel, canning, automobile parts, telegraph equipment, furniture, cement, chemicals, mining machinery, etc. The former leading manufacturer of salt is still carried on at the brine springs on the shores of Onondaga Lake, and the extensive chemical works of the Solvay Process Company employing 5,000 hands are a working plant. (See History in this article). The printing industry is also extensive, more than 60 newspapers and periodicals being published, several of them devoted to the arts and sciences. The wholesale trade supplies hundreds of small dealers in the surrounding country in a radius of many miles. The retail trade involves an area of 38 miles radius and conservatively speaking brings 5,000 shoppers to the city each week. Six banks have a combined capital of slightly more than $6,600,000 with a large surplus. Two savings banks have 85,000 depositors and $48,000,000 of assets.

Buildings.—The business section is completely built up of brick and Onondaga limestone mainly; there are a number of exhibits of present-day architecture and construction, such as the Onondaga County Savings Bank building, the University buildings, City Bank building, University Club, Young Men's Christian Association, Keeler Theatre, Trust and Deposit building, Syracuse Trust Company, the Hunter-Tuppen Company and
Dey Brothers and Company’s department stores, the high schools, courthouse, library and others. The Syracuse University, particularly the John Crouse College of Fine Arts, are all models of good architecture, and the Hall of Languages is a fair example of the excellence of Onondaga limestone, which exists in such vast quantities for building purposes.

Education.—The public schools are under the direction of eight commissioners, who appoint a superintendent at a salary of $4,000 per year. There are 38 public school buildings, having a valuation of $3,444,838. The number of pupils registered in the public schools for the year ended 1 July 1918, was 22,344, and in the high schools 3,358. The buildings are of brick, substantially constructed and supplied with the most modern sanitary appliances and heating apparatus. The course of study is according to the most advanced ideas, and a graduate of the high school is quite as well equipped as were graduates of most colleges half a century ago. Teachers’ meetings are held monthly under the direction of the superintendent, not only to preserve uniformity in the system, but also for the instruction of teachers in their general as well as special duties. The Syracuse University (q.v.), embracing the colleges of liberal arts, fine arts, law, medicine, forestry, and applied science, is situated on the highlands in the southeastern part of the city and has an ample campus of 100 acres. The property, including endowments, is valued at $3,156,711. There are 3,540 students in attendance; the professors and instructors number 344. It is under the control of a chancellor and board of trustees and affiliated religiously to the Methodist Church, though very liberal in this respect. The library comprises over 99,000 volumes and 43,000 pamphlets. An observatory, one of the largest in the country, is an interesting part of the tower of the buildings of the College of Fine Arts is a chime of bells, and on an upper floor in the Hall of Languages building the Central New York Weather Observation Bureau is located and maintained by the United States government. All of the athletic sports are maintained, and the secret societies have fine fraternity houses.

Libraries.—The Syracuse Public Library system including three branches and 34 stations centers in the Carnegie Building which was completed in 1905 at a cost of $150,000. The Carnegie library contains about 140,000 books and in 1918 had a circulation of 556,437 among 43,921 borrowers. The main library is the center of many public activities, including the Americanization work of the city. The service of the library is free. The library of the Court of Appeals in the Court House is one of the three best libraries of the State, by which it is maintained.

The general library of Syracuse University is housed in a building donated by Mr. Carnegie and is rich in certain lines of research material. The State College of Forestry connected with Syracuse University maintains a special library for forestry students. The College of Medicine has a well-equipped library for physicians and surgeons.

Religion and Charity.—Of churches and missions there are 116, of denominations as follows: Methodist, 23; Roman Catholic, 17; Presbyterian, 12; Baptist, 10; Episcopal, 8; Lutheran, 8; Jewish, 7; Congregational, 6; Evangelist, 2; Reformed, 2; Christian, 1; Unitarian, 1; Universalist, 1; Scien; Seventh Day Adventists, 1; missions. There are 13 cemeteries, of which Oak is stands first because of its rolling surface. Shading oaks, impressive entrance way, and costly memorials. Burials were made in the present enclosure of one of these cemeteries nearly a century ago. There are principal hospitals, namely, the Good Shepherd, Saint Joseph’s, Homeopathic, Menorah, Crouse Irving. Each hospital is a training school for nurses. The Syracuse Hospital Dispensary affords medical relief to the poor and ministers to those in need of medical care. The Orphan Asylum, the Saint Vincent De Paul Orphan Asylum and the House of PROVIDENCE are the three principal homes for orphans and homeless children, the first being under Protestant patronage, the others having Catholic support. The State Institution for Feeble-Minded Children is situated on an elevation on the western boundary of the city and is under the supervision of a superintendent and board of trustees. A small farm is connected with the institution which not only gives easy employment to a certain class of inmates, but produces a considerable quantity of supplies. The buildings are of good architecture and the grounds in their vicinity covered with a variety of shade trees and shrubs. The condition of the inmates, which is hopeless a few manifest some improvement after long and patient effort on the part of the teachers.

Public Utilities.—Water is brought from Skaneateles Lake, 20 miles away, at an elevation of 440 feet above the lake, and flows to the city through 18 miles of mains and 3,042 fire hydrants. The water works have a capacity of 1,144,000,000 gallons per day and is supplied by springs. The immediate supply is from a reservoir of 17 acres 220 feet above the main level of the city, which gives a hydrant pressure of 95 pounds. Almost every part of the city is supplied; the water bureau bears the cost of connections between mains and curbs. There are 260 miles of mains and 3,042 fire hydrants. The bonded debt for the waterworks is $4,100,000.

The fire department comprises five gasoline pumping engines and hose carts; two triple gasoline pumping engines and chemical hose carts; four steam-fire engines, tractor drawn; six gasoline combination chemical hose wagons; two horse-drawn combination hose wagons; four hook and ladder trucks, tractor drawn; one hook and ladder truck, horse drawn; one water tower;
strict chiefs' auto runabouts; one chief's motor-supply wagon; one horse-drawn wagon. It is under the command of a chief assistant and the respective capts of the several companies. The police force is 250 men and a special force of deputys, all under officers of grades from chief to constable. The inspections and parades of the chief constable show good drill and discipline and the city is rated high. The sanitary conditions are under the observation of a health officer being salaried. He is collected by day labor and is burned for a tax at a certain contract price. The statistics show an average annual rate of 13.1 per 1,000 of population.

Syracuse—The municipal government is united under the uniform charter of the second class of the State, the mayor and administrative council being in the control of the community. The mayor of 19 aldermen, representing the same wards, and with the mayor elective every two years. A president of the common council, comptroller, city treasurer, four aldermen and eight members of the board of directors are also elective. The common council is responsible for safety, having control of the fire and public health departments and of the water; the commissioner of public works, the city engineer, the corporation counsel and commissioner of charities are also members of the council. The mayor, corporation counsel and city engineer constitute the board of public works, and all contracts and furnishes all supplies to the various departments. The mayor, president, common council, corporation counsel, aldermen and city engineer constitute the estimate and apportionment, which up the annual expense budget and fixes the rates of city officers, subject to the action of the common council. The Municipal is presided over by two judges and its number number more than 3,000 a year, invested with considerable power and authority.

Syracuse—The territory now occupied by the city is also territory both north and south of known to white men, as early as 1620, when the French, and subsequently by the Eng-lish, came up what are now the Oswego and Seneca rivers, through Onondaga Lake, Ontario, and left present traces of Invasions throughout the central and western parts of the southeastern part of Onondaga County. Possession of the land was by the Indians (mainly the Onondagas), and there abundant evidence of the presence of battles has been shown by the presence of stone arrow points and hatchets. The Iroquois were more or less in the invasions, but the brunt of the resistance was with the Onondagas, who were in possession of the land. The Iroquois were more or less in the invasions, but the brunt of the resistance was with the Onondagas, who were in possession of the Six Nations, and it has always been with them. By treaties with friendly native white people and the State, the One-onas from time to time were induced to surrender their possessions, until finally they were allotted a reservation a few miles south of the city, where they were to occupy permanent homes and makes the best of the rocky hills constituting most of their land. The Onondagas, to the number of about 425, still exist, wedded to their habits and traditions. Many of them speak English and a few attend the Methodist or Episcopal mission and a goodly number of the children attend a school supported by the State. The religion of most of them is essentially pagan, and many of those who profess to be converted to the Christian faith find it difficult to divest themselves of pagan leanings. When emigrants began to come to the locality from New England as early as previous to the Revolutionary War, they were received kindly by the Indians, even if they recognized the fact that they were in sense trespassers, so that when the county was created in March 1794 there was a considerable settlement scattered over most of it. As early as 1789 the Salt Springs, long known to the Iroquois as a source of salt, became known to white settlers, and they, in a crude manner, began the manufacture of salt and sent quantities of it to the Eastern market. The State assumed control of the Springs in 1797 (20 June) and leased lots and privileges to whomsoever might desire them; during the remainder of that year 26,374 bushels of salt was produced and inspected by the State officials, the lessees being required to pay a royalty or tax per bushel produced. The annual product increased rapidly so that in 1810 452,050 bushels were made; (1820) 458,329 bushels; (1830) 1,413,446 bushels; (1840) 2,621,305 bushels; (1850) 4,268,919 bushels; (1870) 8,748,115 bushels. About 1890 the annual product began to diminish, mainly because of competition at Warsaw and in Michigan. It was estimated that at one time the Springs gave employment, directly and indirectly, to one-half of the population of the city; but with their decadence, more and more attention was given to the development of manufacturing industries, which have now become numerous, having vast capital and being the main support of the wage-earners of the city. Principal among these is the Solvay Process Company, whose extensive works are situated just across the west line of the city, on the State Barge Canal and New York Central Railroad. The company also has branch works at Delray, Mich., near Detroit, which have a capacity of about 500 tons of alkali per day. The amount of capital invested at Syracuse is estimated at $6,000,000 and about 5,000 men employed. The principal products are soda ash, bicarbonate of soda, caustic soda and crystals, of which the daily output is estimated at 1,000 tons. This company also makes coke, tar, ammonia, carbolic acid, picric acid and some other coal-tar products. Here again salt becomes both indispensable and profitable, for it is an essential element in the production of alkali, by the so-called ammonia process, which is employed here. The company gets its brine from wells which it sunk near Tully, some 20 miles south of the city, and brings the brine to its works through iron pipes. It was in the sinking of
SYRACUSE—SYRACUSE UNIVERSITY

these wells that the source of the brine which for so many years has been utilized in Syrac-
urse was found, in the mass of solid salt, ex-
tending, no doubt, for many miles east and
west. It was found necessary to discharge fresh
water into some wells, when it would become
saturated and then pumped from other wells to
these to the works. Experiments made at this point in the belief that the discov-
ery would verify the source were justified. The
supply was supposed to be absolutely inexhaustible,
but singularly enough the brine is not suitable for
the best quality of salt, which is still pro-
duced from local wells to the extent of nearly
2,000,000 bushels per year. The company proc-
cures its limestone from Split Rock, several
miles southwest of its works, bringing the ma-
terial in by means of large buckets suspended
on overhead wires and moved by steam power.
They run in close connection and continuously
and are capable of transporting 1,000 tons in 12
hours. A vast excavation has been made in the
great layer of rock, of much breadth and thick-
ness. Much of the building stone came from
this quarry before it was converted to its pre-
cent purpose. The "waste" product of the works
has been used to fill surrounding low lands un-
til hundreds of acres have been covered to
great depths and places of deposit are now so
limited that Onondaga Lake will henceforth be
used as the place of discharge. The material
is white and like marl and possesses no sus-
tenance for vegetation.

The State Fair is always a feature of the
social life of Syracuse, as well as entertainment
for thousands of people from abroad. The
grounds, situated on the western border of the
city, consisting of 100 acres, quite covered
with buildings for various purposes, embrac-
ing a very costly speeding track, are owned
by the State, under an act of the legislature
making the establishment permanent. Several
clubs of large membership, the Century leading
and much the oldest, are centres of sociability
and places for business conferences among
men, while there is one woman's club, the
Kanatenah, and many other social organiza-
tions.

Population.—When the county was created
in 1794 the county-seat was established at
Onondaga Hall, four miles southwest of the
present city centre; but the construction of the
Erie Canal and development of the salt works
caused a change of the county-seat to
Syracuse in 1827, when the population of the
county created in 1825 had increased to about
30,000. The population of Syracuse has in-
creased steadily and very rapidly, as follows:
1800, 1,819; (1810), 2,271; (1820), 3,275; (1830)
1840, 4,575; (1850), 8,114; (1860), 13,051; (1870),
18,813; (1880), 31,714; (1890), 51,843; (1900),
73,281; (1910), estimated 101,000.

FREDERICK F. NORTON,
Secretary, Syracuse Chamber of Commerce.

SYRACUSE, ancient SIVIGOSA, Sicily,
a city and port on the southeastern extremity of
the island, 80 miles southwest of Messina.
It is a harbor but has greatly de-
clined from its ancient prosperity
when it had a population of 500,000 inhabitants.
In 214 B.C. it was destroyed by Carthaginians.
At the northeastern portion, contains all that re-
 mains of the ancient city. Here are seen ruins
of a Greek temple, dedicated to Diana of
Apollo, a castle, remains of ancient baths and
medieval palaces, a cathedral built within the
columns of a Doric temple to Diana or Minerva.
There is also a museum containing valuable
antiquities, coins, etc. In the southern portion
of the town is the fountain of Arethusa, called
La Purrca by the inhabitants, whose water
became salty after an earthquake. Parts of
the walls of the ancient city are preserved, which
formerly enclosed the entire city on the main-
land, also of the two great aqueducts; a Romas
amphitheatre of the age of Augustus; a Greek
theatre of the 5th century B.C.; a temple to
Ceres and extensive catacombs; the massive
towers of the fortifications of the castle
Euryalus in the northwest, subterranean pas-
sages hewn through solid rock, etc., with end-
less ramifications in all directions. The Ear of
Dionysius, a deep grotto with a wonderful
echo, is 170 feet long, 60 feet high and 20 to
35 feet wide. Syracuse was founded by Greek
Corinthians in 734 B.C. Its early political his-
ory is obscure; it is known that it thrived and
itself sent out other colonies, becoming the
largest and wealthiest city of the Old World.
It had at one period a democratic government.
In 215 B.C. it was invested by the Romans and
defended by Archimedes for three years, but
finally surrendered 212 B.C., remaining in
possession of the Romans till the down-
fall of their empire. Theocritus and Archimedes
were natives of Syracuse. An increasing ex-
port trade is carried on in olive oil, lemons,
sugar, oranges, etc. Pop. 27,352. See W. H. Kurl.
C., 'Southern Italy and Sicily' (16th ed., Leip-
zig 1912); Freeman, E. A., 'History of S. i.'
(4 vols., Oxford 1894); Cavallari and L.,
'Topografia archeologica di Siracusa' (Palermo
1893, 1895).

SYRACUSE UNIVERSITY, located at
Syracuse, N. Y., was chartered in 1850.
The collegiate department, which was first
opened in 1871, was the continuation of Geneseo
College, founded at Lima, N. Y., in 1849. In
1872 the Geneva Medical College, founded
in 1835, was moved to Syracuse and became
the College of Medicine of the university and in
1873 the College of Fine Arts was organized.
This latter was an experiment in American
education and has proved eminently successful.
The College of Law was added in 1885, the
College of Applied Science in 1901, the
Teachers' College in 1906, the Library School
in 1886, the Summer School in 1901, the Grad-
uate School in 1911, the New York State Col-
lege of Forestry in 1911, the College of Agri-
culture in 1910, the School of Oratory in 1914.
The Hospital of the Good Shepherd became a
part of the university in 1915. The College of
Liberal Arts offers one course leading to the
degree of A.B. The course includes certain
required studies, one major subject (six hours
a week for two years), one minor subject (three
hours a week for two years) and free elec-
tives to complete the required number of hours.
Institution in Bible study is a part of the cur-
riculum but the courses are elective. The
Graduate School offers five degrees, the de-
grees of A.M., M.S. and Ph.D. The College of
Fine Arts offers a four year's
course in architecture, leading to the degree of
B.A., a four years' course in painting, leading to
gree of B.P., four-year courses in piano, organ and violin, leading to the degree of B.Mus., and in the college leading to the degree of B.C.L. These courses include in general history, philosophy, etc., as in history, theory and practice of the College of Medicine offers a four-course leading to the degree of M.D., and that of Law a three-year course leading to the degree of LL.B. Two years of college is spent in a college of liberal arts, in seven years the college and medical in eight and in seven years. The College of Ap- science offers courses in civil, electrical, chemical engineering, and degrees of C.E., E.E., M.E. and B.S. medical engineering. The students main- ner, historical and scientific associations the Greek-letter fraternities are well know and is one of the reasons for its popularity. There is a general collegiate course and there is a general in athletics. All business of the ath- lons is in the hands of the athletic gov- board, which includes representatives of the student body and the college. The men include Winchell Hall, Haven Hall, fall and eight cottages. Sims Hall is mitory for men. Many of the students their fraternity houses. The campus is 100 acres situated on a hill overlook- city and surrounding country. The farm is one mile from the. The buildings of the university in- the Hall of Languages, the Demarest Holden Observatory, the Library, the John Crouse Memorial (for the College of Fine Arts), the of Medicine, the College of Law, the Stadium and Gymnasium, the Gymnasium, the Emma Baker Steeple Physics, the Lyman Cornelius Smith of Applied Science (containing shops and wood work), the Administration g. Lyman Hall of Natural History, the School of Chemistry, New York State of Forestry building, the Photography r, the free dispensary, Margaret Olivia Teachers' College, the Joseph Slocum of Agriculture, nearly a block of hos- tels and the University block, one largest commercial buildings in the in- of New York State, erected for invest- poses. In 1902 the United States gov- t established a weather observing sta- th complete equipment in the Hall of ges. The library contains over 100,000 s, including the general library, the his- library of Leopold von Ranke, purchased and other special libraries in economics, etc. The Syracuse City Library and the Syracuse State Court of Appeals to students. The students number 200, of whom 1,500 are in the College- ral Arts, and the faculty, 325.

JAMES R. DAY, Chancellor.

IA, a country of western Asia, geo- ally and anthropologically a kind of peninsula of the Mediterranean, forming a bridge between north and south, connecting Asia Minor and Mesopotamia with Egypt, and bounded by the sea on the west and by the desert, only some 60 miles inland (at the narrowest part) on the east. The name "Syria" is rather a geographical expression than a geographical fact, for the region which bears that name on our maps is actually delimited by modern (Christian) geographers. The name was originally of much wider application than it is now, while even to-day, strictly speaking, it includes Palestine. The subjects of the Assyrian Empire, from the Black Sea to the Mediterranean, were known in ancient times as Assyrians or, in the abbreviated form, Syrians. These two names came at a later period to have different applications: Whereas "Syria" once meant all the Assyrian Empire and also Mesopotamia, it became usual with the Greeks and Romans to apply that name to the more western of these regions, but including Palestine. Later, on, Christian semi- ment created imaginary boundaries and the Holy Land was from a part of itself, a proceeding that gave birth to the prevalent erroneous impression that Syria and Palestine are two distinct countries. Geographically and geologically they cannot be separated; the mountains of Pale- tine, both on the western and eastern sides of the Jordan, are, respectively, the terminations of the Lebanons and Anti-Lebanon Mountains. The Jordan Valley is a continuation of the Bika Valley, and three out of the four sources of the river Jordan itself are in Syria. The district we describe as Palestine no longer means as once "the land of the Philistines," and always has included much which the Philistines never held; it was never entirely held by the He- brews for any length of time. Its boundaries correspond with the idealized limits of Canaan as divided among the 12 tribes, with the possessions of the Hebrew kings in the days of their greatness, and with the Palestine of New Testament history.

Syria, under Turkish rule, was divided into four vilayets and two "independent sanjaks" as follows: Aleppo, 33,430 square miles, pop. 1,500,000; Syria, 37,020 square miles, pop. 2,000,000; Beirut, 6,180 square miles, pop. 533,500; Lebanon, 1,190 square miles, pop. 200,000; Zor, 30,110 square miles, pop. 100,000; Jerusalem, 6,600 square miles, pop. 341,000. The last two are "sanjaks"; the whole of Palestine was in- cluded in that of Jerusalem and the vilayet of Lebanon. Total area, 114,530 square miles; pop. 3,675,000. Of the area, not more than 12,000 square miles comprise Palestine, to which also belong between 600,000 and 700,000 of the population. The ancient inhabitants called the country "Arab," of which name the Biblical "Syria" is a translation. The Arabs called it eesh-Shâm (the left) north of Mecca and Me- dia; and Yemen (Yamin) to the right of those cities. Damascus, believed to be the oldest city in the world, was the capital of the Aramaic kingdom. While the modern inhab- itants use the ancient, inclusive name Surtiya, the Arabs call both Syria and Damascus eesh- Shâm; the Turkish name is Syria (also Shâm); the Persians call it Soristan.

Topography.—Regarded in the ordinary sense of the name, Syria is the long and nar-
row district on the eastern shore of the Mediterranean, extending from the Taurus range on the north, the sea and air, to Egypt on the southwest, between 36° 5’ and 31° N. lat. and long. 33° 30’ and 39° E. The Euphrates forms the northeastern border; the Syrian Desert the eastern limits, and Arabia on the south and southwest. The Mesopotamian plains are separated by the desert from the Mediterranean coast region, which stretches nearly in a straight line from the Sinai Peninsula northward to Anatolia. The desert forms a chalk and limestone tableland rising gradually to an altitude of over 2000 feet above sea-level, stretching away southward into the Arabian Peninsula, but on the west sinking abruptly down to the long, deep and narrow depression of El-Ghor, which forms the eastern limit of the southern section of the coast region known as Palestine. Farther north the desert merges imperceptibly in the plains of Damascus and Aleppo and thus presents no natural well-defined limits to Syria on the east. Elsewhere the breadth is 440 miles, the length north and south is variously estimated at between 370 and 430 miles, with a mean breadth of 100 miles, narrowing in the south to 60 and expanding northward to 150 miles. Palestine is cut off by the Lowr Orontes (Nahr el-Asi) and Mount Hermon from Syria proper, measuring from this point to the southern end of the Dead Sea (Bahr Lut, i.e., Lake of Lot) about 160 miles, with an average breadth of 70 miles, the north and south sections of the plateau only differentiated from the North Arabian Desert by a picturesque mountain-wall, split in the north into two parallel chains—the Lebanon and Anti-Lebanon, the latter falling gradually northward down to the plains of Upper Mesopotamia, while the former is continued by the less elevated Jebel-Nusarieh as far as the plain of Antioch, about the 30th parallel. North of this plain the Jebel-Nusarieh is continued by the Giaour-Dagh and Akk-Kul to the Taurus above the Gulf of Alexandretta. These ranges condense the vapors from the sea and remain snow-clad till late in summer, giving the 10 to 16 miles’ breadth of the Syrian seaboard its luxuriant slopes, the snow-line is usually solid as far as its southern borders. The Lebanon range runs for about 90 miles southwest and approaches at some points to within 8 or 10 miles of the Mediterranean, presenting to seaward the appearance of bare, rocky walls surmounted here and there by a few snow-decked peaks, 10,200 (feet) and Jebel-Makmal (10,020 feet). From these is derived the name of Lebanon (white mountains), which was already current in the time of Moses. Despite its rugged appearance the Lebanon contains many fertile slopes and valleys, well cultivated and thickly populated. Eastward it is cut off from the Anti-Lebanon by the still more fertile plain of the Bekaa (Coele-syne Arabia), and westward from Mount Carmel by a low range of hills, the exterminy of the Anti-Lebanon rises in the Jebel-sh-Shih (Mount Hermon) to an altitude of nearly 10,000 feet, the culminating point of Mount Hermon and the Anti-Lebanon, separated by the isthmus of Lebanon, a lateral branch, which farther south is separated from the sea by a fertile plain. Within this region are situated the oldest and most famous places in Palestine, including the mountains of Naphtalim, and of Ephraim and Judah. In this range which prevents the Jordan from flowing toward the sea and compels it to follow a southern course until it loses itself in the Dead Sea. Excluding the southeastern flanks of Hermon, both the Lebanon and Anti-Lebanon ranges are of limestone formation; the former is a single ridge deeply marked from the effects of erosion by water, while from the latter five ridges diverge northward. The spaces between them is taken up by a plateau of from 4,000 to over 5,000 feet above sea-level. The depression of El-Ghor, referred to above, is the deepest in the earth’s crust, falling about 13,000 feet below sea-level, or more than 4,000 feet lower than the Bekaa plain. The four main streams—the Litani, Orontes and Alana—rise in the neighborhood of Baalbek, under the 34th parallel. They flow in four opposite directions, south to the Dead Sea, southwest and northwest to the Mediterranean, east to the Bahr el-Asi, and to Buebeh, some five hours’ journey beyond Damascus. The Euphrates, breaking the Taurus in a succession of cataracts and rapids, flows south and southeast, separating Mesopotamia from Syria and the rest of Asia Minor. It is joined by the Tigris at Kurna. The course of the Jordan are the lakes of Merom (El-Huleh) and Tiberias, and at its mouth is the Dead Sea. There are few perennial streams in Syria; the rain is quickly absorbed by the stony ground. Some of the old river-beds (wadis) are deeply eroded. The mountain chains divide Syria into three regions—a western, consisting of a narrow belt of lowland extending between the sea and the mountains, sometimes called the Lebanon valley; a central, occupied by the principal mountains of the chain; and an eastern, consisting for the most part of a bare, arid, sandy plateau, occasionally relieved by a few oases. Above all the towers Mount Hermon feasts the fertile plains of Syria and forming a valuable landmark for the guidance of caravans. The Little Ghora or plain of Gennesareth stretches west of Lake Tiberias. On the eastern border of Syria extends the interior of the country, a fertile steppe, which when artificially watered yields the most luxuriant produce. This region, which is called the desert on account of its lack of water, stretches at a mean level of 1000 feet to the vicinity of the Euphrates. It is inhabited by independent, nomadic Bedouins and frequently traversed by caravans. Beyond the Jordan, not far from Mount Hermon, rise the volcanic hills of Tuhil. To the south of Damascus lie the ancient wheat-bearing plains of Hauran and Pisgah, and the Syrian desert region in which numerous ancient inscriptions are to be found. Farther south extending the mountains of Gilead, partially wooded. The mountains of Moab form an extensive tableland, and separated by a low range of hills. Between the Haarrus and the Oasis of Damascus there stretches a broad expanse of volcanic hills, the Eastern
nitis (Tulul-es-Safa), toward the north-
ge of which stand the stupendous ruins
myra (Tudmur), supposed to have been
Solomon. The Alâ region between damascus and Aleppo forms an ex-
- basalitic upland tract for many miles
of the Orontes. Here are the ruins of
ancient cities. In the extreme north the
larger part of the Alâ region, Umk and Aie
ocupy all the space between the bend of
phrates and the coast range, and are
habited by Turkoman and Armenian
turists. This region marks the extreme
of both of these races toward the south-
West of the Umk plateau lies the Bahr-
(Lake of Antioch), a fine sheet of
cuet miles by six, formed by the junc-
tion of several steppe streams and draining to
ontes.

Flora and Fauna.—Vegetation is much
varied and luxuriant in the north than in
the south. The fertility of the soil of Syria is
by many ancient writers as well as in
the Bible. Even the Syrian desert consists,
some extent, between Haifa and Haret-as-
ry rain produces a rich crop of grasses
owering herbs, affording most valuable
The whole coast-distict belongs to the
of the Mediterranean flora, which ex-
round the basin of that sea, reaching in
as far as the lower hill country. This
region is, therefore, similar to that of
Algeria and Sicily, with some modifica-
the direction of Egypt. Among the
products are corn, cotton, fruit in al-
endless variety, indigo, sugar cane, grapes,
mulberries, olives and tobacco. The
especially of the Latakia district
Cyprus is noted for its powerful, aro-
flavor. What still remains of the his-
cards of Lebanon is now found only at
ry spot a few miles below Tripoli; far-
the rose of Sharon is still cultivated.
, as the higher ground of the interior is
ched, the vegetation changes to that of
rential type, a great variety of species
a dry and thorny undergrowth and
I trees. The vegetation of the Jordan
somewhat resembles that of Nubia on
ge of the tropics. Considerable quan-
traisins are grown round Damascus and
. Pistachios are raised in northern
and nuts in central Syria, while in the
near Damascus and east of the Jordan
saltwort is grown extensively. The gall
produced by the oaks of the north are
exported to Europe for dyeing purposes.
products are licorice, alizar or madder,
ark of the pomegranate tree (used in tan-
and sumach, figs, citrons, pomegranates
mondo, cucumbers, onions, artichokes,
unt and truffles. While the cedar and cy-
is growing rare, the pine is common;
sk and the poplar willow are frequently
ith, as well as the terebinth or turpentine
and the Valonia oak.

One of the chief are the Syrian
the hyâna, jackal, boar, panther and
A connecting link between the domestic
wild animals is formed in Syria by the
the cat. Each town and village is in-
with livestock to whom they were racially related, though of a
different faith—Islam. That religion is an eclectic compound of popular Christianity

Mountains. Gazelles are hunted in eastern
Syria. The numerous caverns harbor several
varieties of bats; there are four species of
hares and numerous rodent-like
inhabited by Turkoman and Armenian
namentals. This region marks the extreme
of both of these races toward the south-
West of the Umk plateau lies the Bahr-
(Lake of Antioch), a fine sheet of
arate miles by six, formed by the junc-
tion of several steppe streams and draining to
ontes.

Flora and Fauna.—Vegetation is much
varied and luxuriant in the north than in
the south. The fertility of the soil of Syria is
d by many ancient writers as well as in
the Bible. Even the Syrian "desert" consists,
some extent, between Haifa and Haret-as-
ry rain produces a rich crop of grasses
owering herbs, affording most valuable
The whole coast-distict belongs to the
of the Mediterranean flora, which ex-
round the basin of that sea, reaching in
as far as the lower hill country. This
region is, therefore, similar to that of
Algeria and Sicily, with some modifica-
the direction of Egypt. Among the
products are corn, cotton, fruit in al-
endless variety, indigo, sugar cane, grapes,
mulberries, olives and tobacco. The
especially of the Latakia district
Cyprus is noted for its powerful, aro-
flavor. What still remains of the his-
cards of Lebanon is now found only at
ry spot a few miles below Tripoli; far-
the rose of Sharon is still cultivated.
, as the higher ground of the interior is
ched, the vegetation changes to that of
rential type, a great variety of species
a dry and thorny undergrowth and
I trees. The vegetation of the Jordan
somewhat resembles that of Nubia on
ge of the tropics. Considerable quan-
traisins are grown round Damascus and
. Pistachios are raised in northern
and nuts in central Syria, while in the
near Damascus and east of the Jordan
saltwort is grown extensively. The gall
produced by the oaks of the north are
exported to Europe for dyeing purposes.
products are licorice, alizar or madder,
ark of the pomegranate tree (used in tan-
and sumach, figs, citrons, pomegranates
mondo, cucumbers, onions, artichokes,
unt and truffles. While the cedar and cy-
is growing rare, the pine is common;
sk and the poplar willow are frequently
ith, as well as the terebinth or turpentine
and the Valonia oak.

One of the chief are the Syrian
the hyâna, jackal, boar, panther and
A connecting link between the domestic
wild animals is formed in Syria by the
the cat. Each town and village is in-
with livestock to whom they were racially related, though of a
different faith—Islam. That religion is an eclectic compound of popular Christianity
and Judaism. Their language, Arabic, was most properly spoken in all Syria, while an Arabic Christian dynasty had existed in Damascus even before the invasion. These vigorous sons of the desert brought about a double process of assimilation. They learned eagerly from the natives, from the Persians and the Greeks. They were apt pupils who in many cases were not only able to improve upon the wisdom of their teachers, but also to absorb and mold all this foreign learning into the Arabic language, even to the extent of applying Arabic equivalents for the technical words of science or philosophy instead of using the Greek forms. That process of acclimatizing foreign ideas and culture is still prevalent among Syrian writers to-day. The Mohammedan invaders absorbed many of the old customs and religious traditions of the soil and adopted the old shrines of saints in different communities and gave them Mohammedan names. Through their language they impressed their own poetry, national heroes and saints upon the people with the result that the modern Syrian writers echo the voices and thoughts of Arabian bards and philosophers.

In the Syria of to-day the Christians, Mohammedans and Jews possess a common heritage of proverbs, legends, parables and superstitions. Indeed, it is no exaggeration to say that the modern Syrians are one people with the same fundamental outlook on life, despite their different religions and sects, characteristics, class distinctions and various dialects. In this happy blending of races the cultural endowments of the people are favorably exemplified by the Christian section of the population. They form a highly intelligent people with a remarkable capacity for adopting European ideas. The admixture of Greek and Arabic blood seems not to have impaired the good qualities of their Phoenician and Aramaean ancestors. The inhabitants of the coast districts are still Phoenicians in their enterprising spirit, commercial skill and love of travel. In Marseilles, Liverpool and Manchester, Syrian merchants are settled who promote the interests of their native land, extending their trading relations to Scandinavia and North America. Intelligent industry is responsible for the prosperous condition of the Beirut Christians. Here property is rare, and even engaged in some branch of industry or trade. Family life is simple and patriarchal. The women are thrifty housewives and devoted to their families, associating little with the outside world. The Greeks and Turksomans (q.v.) are alien races; the old Syriac or Aramaic tongue is spoken only by the Nestorians of Kurdistan; the Turkish officials and soldiers under the old regime spoke their own language.

Education and Religion.—Under Turkish rule elementary education was nominally compulsory for all children of both sexes, while the Ministry of Public Instruction provided for the inspection of schools maintained by non-Nestorian Christians. There were many native schools and other educational institutions maintained for foreign missions. In the numerous girls' schools instruction is limited mainly to the study of French and English. The Government has an excellent training school where women's work is taught and native teachers are trained. The rival houses of the "Sisters of Nazareth" and of the "Prussian Deaconesses" are highly praised for their labors, while the American mission especially in Damascus and Homs has been highly beneficial.

In religion the bulk of the inhabitants are Mohammedans; the Christians make up one-fifth of the total, and are divided into Greeks, United Greeks, Maronites (men resided especially in Gerami), Nestorians and Protestants. The number of Jews is estimated at 20,000. Protestantism is making rapid progress in the Lebanon. In the north dwell some Bedouin Ishmaelites who have a familiar word to speak the Jewish tongue. In the south dwell some Bedouin Ishmaelites who have a familiar word to speak the Jewish tongue.

Town.—In Syria many of the great cities in the world, such as Damascus, Aleppo, Emir, Beirut, and Tripoli, have flourished and retained their ancient names but recognizable forms. Tyre, Baalbek and other famous places either disappeared or shrank into obscurity. The principal seaports of Syria are found on the coast of what was once the home of the most famous navies of antiquity. Beirut is the chief port and has the largest and most flourishing trade in the Levant. Other ports are Latakia and Tripoli; the southern ports of Sidon, Tyre, Acre, Caesarea (Kaiser Ascalon, have lost their trade and during the centuries since the Crusades now little more than fishing villages of local traffic. Jaffa (Joppa) has recaptured its former prosperity owing to the industry and the Jerusalem Railway. Aleppo (iskandrun), in the extreme north, is the finest harbor on that coast, but is prey to stricken spot in that region (Seleucia), about 30 miles south of the town, also has a fine natural harbor. The feature of this district is that all the inhabitants are afflicted with one disease, called the "Aleppo Button," or the "Button of Sin." Each the result of a boil that always year before healing. Europeans are still affected by this disease often during only a few years in Sidon (q.v.), now called Saida, is of able historical interest.

Communications.—Of the three routes which have been the main thoroughfare between Europe and Asia—namely, the Euphrates Valley and the Indus—Syria possesses the most ancient direct route. From remote antiquity it has been a main channel by which the riches of have flowed to the East, and to the Indo-Syrian trade route has been the main route of the great powers, for the traverse between Europe and Asia. The first great traffic routes were the Phoenicians, and the presence of the Phoenician sea power was profoundly important. Their trade connections with the countries of Europe and Asia were maintained by means of the Phoenician trade routes. The Phoenicians maintained trade connections with the countries of Europe and Asia. They were especially important for the trade of the 8th to the 12th centuries. Then the Mongol avalanche...
Hauran and Syria. Europe lost her hold on the land route when the Mongols came to the Turkestan in 1279, the Indo-Syrian lines came again into a brief period of parative prosperity. By this time, however, the new trade routes of the East were under the influence of the Ottoman Empire and were therefore largely superseded by the old trade routes of the Mediterranean. The establishment of the British Levant Company in 1869 brought a new impulse to the revival of the old land route until, in 1875, the Indo-Syrian lines came again into a brief period of parative prosperity. But for the discovery of an unbroken waterway to India and the presence of the Suez Canal, this route would have remained the highway of the East. Even in the early part of the 19th century, despite the efforts of sea-borne trade, the prospects of a revival of the old land route were not bright. The proposed Ushratat Navigating Company and Railway were outward bound for a great need which Great Britain was about to recognize, but which Germany eventually took up and attempted to realize in her own way. It is not improbable that historians, delving in the diplomatic and commercial records of the 19th century, will find a place among the "causes" of the Great Powers of the silent struggle for the command of the eastern Mediterranean and the bridge between East and West. From Alexandria to Aleppo the road was now accessible to wheeled traffic. From the port of Jaffa, the pilgrims' route to Mecca and Mekkah superseded the railroad following the "routes" of the Syrian plain as far as Mesopotamia, and certain Arab tribes from the Yemen settled in Syria, particularly in the Hauran. For centuries before the end of the Christian era, Syria was a Roman province, and its magnificence of its architecture. The whole of Christian Syria, including Palestine, was wrested from the Eastern Roman Empire by the Persians in A.D. 611-614. Nomadic tribes of Arabs had from time immemorial ranged over the Syrian plain as far as Mesopotamia, and certain Arab tribes from the Yemen settled in Syria, particularly in the Hauran. For centuries before the rise of Islam the Arabs were everywhere a disturbing element to the Byzantine Empire. The new religion promulgated by Mohammed produced extraordinary results. As by magic, long-standing intertribal feuds among the Arabs disappeared — they became a united nation galvanized by religious enthusiasm. Shortly after the death of the Prophet the Arabs defeated the Byzantines and Syria fell into their hands (636). It was governed by caliphs till 883, and then passed under various masters till it was conquered by the Seljuk Turks, who gradually obtained possession of the whole country (1070-85). The first Crusade began in 1096; Antioch fell to the Crusaders in 1098. By 1118 the kingdom of Jerusalem had been established and the Franks had taken Caesarea, Tripoli and Beirut. The next 140 years included the romantic period of Richard I of England and the Crusades. The latter becoming master of the whole of Syria except the Frankish possessions (1183). North and central Syria were conquered by the Mongols in 1259-60; in 1291 the Mamelukes ended the Frank rule in Palestine and later united Syria with Egypt. After this period the history of Syria presents few points of interest; internal strife continued between the Mamelukes, Circassian sultans and Mongolian governors. In 1400 came the Mongol invasion of Timur and when great numbers of the inhabitants were massacred. War broke out in 1516 between the Ottoman Turks and the Mamelukes; the latter were defeated by Sultan Selim, and in the following
year the whole of Syria was incorporated in the Turkish or Ottoman Empire — a connection disintegrated by a series of aims later by the Great War. The more important events in the modern history of Syria are its conquest by Mehemet Ali of Egypt in 1833, and its subsequent restoration to Turkey in 1840 by the intervention of the great European powers; and the disturbances that broke out in the Lebanon district in 1860 between the Maronites and the Druses. A Maronite monk was found murdered, and suspicion fell upon the Druses. The latter made a general attack on the Maronite villages near Beirut and a large town under Mount Hermon. With a promise of protection the Turkish commander ordered the Maronites to lay down their arms. On this being done, they were abandoned to their enemies, who thereupon swarmed into their villages and massacred all men, women and children. So far from rendering the promised protection, Turkish troops were said to have assisted in the butchery. France and Great Britain intervened; a rebellion broke out in Lebanon, separated from Syria, and was put down. Its active services, however, were not required. As a result of that intervention the Lebanon district was created an independent sanjak, the governor of which was required to proceed to religious pilgrimage.

During the European War in June 1917 Syria was invaded by a British force under General Allenby who captured Beirut 31 Oct., Geza 7 Nov., and Jaffa 17 Nov. The victorious troops entered Jerusalem 9 Dec., and Palestine, separated from Syria, was created an independent sanjak under British administration.

See Antioch; Bambik; Bashan; Beirut; Crusades; Damascus; Dead Sea; Druses; Gilead; Hittites; Jaffa; Jordan; Lebanon; Mountains of; Maronites; Moab; Palestine; Palmyra; Persia; History; Prisa; Samaria; Semites; Semitic Languages; Syrian Language; Turkey; Turkomans; Tyre; War, European — Turkish Campaigns.

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SYRIAC LANGUAGE AND LITERATURE, one of the members of the Semitic family of languages. It is a variation or dialect of the Aramaic tongue, which covered the districts of Mesopotamia, northern Syria, Palestine, Transjordan, southern Arabia Petraea. The language of Syria, especially in its earlier form, differs very little from Chaldee or eastern Aramaic. The Latin equivalent of the name which is Syriacus and its Greek equivalent mean of or pertaining to Syria or its language.

Language. When Syriac first appeared within the view of history it must have been undoubtedly quite an ancient tongue, since its grammatical forms had assumed great definiteness, though it was subject to constant linguistic influence from the powerful and highly organized peoples by which it was surrounded. In later days it continued to be affected by Greek and still later by Arabic, the latter of which contributed to the language. Syriac was undoubtedly a very considerable body of pre-Christian Syriac literature; but this seems to have disappeared before the iconoclastic and misianary zeal of the Christian priests, though some of it may still be found in the literature of very ancient Syrian cities. Syriac differs very considerably from Hebrew, more especially in its vocal system which is much more con-
than that of either Hebrew or Arabian. Aramaic the prefixed definite article does at times become definite, but no longer definite in the sense that a fixed article is definite. Both Hebrew and Syriac have 22 letters and these are identified and form the dialectic difference of two tongues. In the Christian era the Syriac language, with its religious and theological influence, became the medium of literary expression.

The Syriac tongue possesses seven sounds (َا َا ِ َ ٣ ١ ٣) which are characterised by the living period of the language. These sounds are used in the West Syriac, from the alphabet, applying them in a somewhat different manner; while the East Syriac uses the series of dots by which they are more effective. The close relationship of Syriac to the Semitic is evidenced by the fact that the Semitic group of languages effect modifications in the sounds of the vowels in the Semitic languages, just as they do in Syriac, and the latter has a more primitive system than the former. The profuse system of suffixes to be found in all the Semitic languages has contributed to the Syriac. The Syriac verb is more than the Hebrew verb, but it is noticed that the lack of the original passive forms has been replaced by distinct grammatical forms. Inventions and prepositions shows this is a decided superiority over Hebrew.

One of the most important achievements of Syriac is the invention of the use of an auxiliary, thus enabling the Syriac to express its ideas with greater facility and clarity. The Syriac tongue, in which so much early Christian thought and the presentation of ideas many kinds which have already begun to be used at the door of a new world gious and philosophical imagination and

The Syriac language is of importance as the medium of literary expression of so much of the activities of the Christians and because of the numerous glosses of the Bible or parts thereof now known. The Syriac writers showed a great literary skill in the use of their ancestors and of the Semitic languages. The Syriac language took root and grew steadily in the direction of an analytical construction. Its choice of a tongue in which so much early Christian thought and the presentation of ideas many kinds which have already begun to be used at the door of a new world gious and philosophical imagination and
hymns and poems and 191metrical homilieshave been credited to him. Hedounced the hymns of his times much in the mood of the Hebrew prophets of an earlier age in a forceful manner and in a style rich in imagery and marked with imagination. A hundred or more of his poems still exist. Another writer of some of this period was Narses of Maelthea. To the same century belong Ihas, bishop of Edessa, who was deposed from office on account of his Nestorian writings; Dadhisho, commentator; Narsai, Harp of the Holy Spirit, poet and theological writer, many of whose poems survive; Jacob of Serugh, poet, and Philoxenus of Mabbogh, an excellent prose writer. Among the Syriac writers of the 16th century are John of Tellia; John bar Aphthonya, commentator, poet, hymn writer and biographer; Sergius of Rasain, scholar, translator and grammarian; John of Ephesus, noted church historian; Moses of Aggel, translator and writer; Marutha of Seleucia, commentator, sermon, hymn and epistolary writer; Bodh, legal writer and translator of Persian tales, and Hannana of Haldiaiah, commentator, controversialist and general writer of great activity. Among the historical works of interest written in Syriac are Chronicle of Edessa, Chronicle of Dionysius of Tell Mahre and the semi-religious works of Zacharias of Metylene. The whole body of translations made into Syriac was very large and embraced works from most of the great literatures of the day. This translation continued on into the period of Arabic domination; but Syriac after the middle of the 7th century began to be a dead language. After this period it became the vehicle of the Church and of scholars much as Latin was regarded in Europe. Therefore, the works written in Syriac during the period of Arabian domination are for the most part of a learned nature and the literature tends to run more in a humanistic or philosophical and scientific. Among the most noted of the classical Syriac writers are: Thabit ben Kornrah (9th century); Theoder bar Choni (10th century); Dionysius bar Salibi (12th century), who wrote the History of the Crusaders; Michael of Melitene (12th century), History of the World; Abularr of Gregory (13th century), commentator, grammarian and historian, and Abdisho (14th century), critic, historical writer and author of a careful work on Syriac literature.

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SYRINGA—SZE-MA TS'IEIEN

SYRUS, si'rūs, Publius, Roman author who flourished about 43 B.C. After Laberius he reigned supreme on the stage, and his mimes were full of shrewd epigrammatic wit. About 200 apothegms are still extant under the title 'Witticisms of Publius Syrus.'

SYSTEM, the term applied to the rocks of a given period; thus we say that the Cambrian system of rocks was laid down during the Cambrian period, the Tertiary system during the Tertiary period, etc.

SYZRAN, si'-zá'n, Russia, a river-port near the right bank of the Volga, 90 miles southeast of Simbirsk. It has nine churches, a monastery, convent, grammar school, technical school and banks. The manufactures include leather goods and iron-ware. Trade depends upon grain, fish and salt, great quantities of grain being exported. It lies on the Rjasht-Batonski Railway. Pop. 46,234.

SZABADKA, sō'bôd-kô, Hungary, in the county of Bács-Bodrog, 25 miles southwest of Szegedin and 110 miles southeast of Budapest. The fashionable summer resort of Lake Palics lies within its confines. Its chief points of interest are the schools, hospitals, almshouse and music school. Agriculture is the chief occupation. It has considerable trade in fowls, fruit, cattle, horses, hides, wool, corn and tobacco. Linens and shoes are manufactured. Pop. 94,600.

SZECHUAN, sā-ch'oo'-ān, China, the largest province of the republic, in the west, with Tibet on the northwest and Yunnan on the southwest; area, 218,400 square miles. It is traversed and watered by the Yang-tse-Kiang and its affluents, is hilly throughout, mountainous in the west and rich in natural products, including coal, iron and other minerals. Opium, silk, salt, sugar, medicines, tobacco, hides, musk, rhubarb and white wax (produced by an insect) are exported to the annual value of $25,000,000; and European cottons and woolens are imported to the value of $15,000,000 annually. The capital is Cheng-tu, the chief commercial town Shung-king, which was opened to foreign trade in the end of 1899. Ichang was thrown open in 1877. Pop. of province 54,500,000. (See CHINA). Consult Baber, 'Travels and Researches in Western China' (London 1882); Bishop, 'The Yang-tse Valley and Beyond' (New York 1901); Hosie, 'Three Years in Western China' (ib. 1890).

SZE-MA KWANG, sē'-mā' kwang', Chinese statesman and author: b. 1009; d. 1086. He is remembered as the author of 'The Comprehensive Mirror of History,' in 294 books, the labors of 19 years. It covers a period from the beginning of the 5th century B.C. to A.D. 960. Sze-ma is also the author of 'Ki-ku-ku,' or 'Investigations into Antiquity,' which brings her history down to 1066 A.D. He also wrote a dictionary and numerous essays are ascribed to him. Consult Giles, H. A., 'History of Chinese Literature' (New York 1901), and Rémuat, 'Nouveaux mélanges asiatiques' (2 vols., Paris 1829).

SZE-MA TS'IEIEN, sē'-mā' ch'en', Chinese author: b. 163 A.D.; d. 89 A.D. Born in Lungmun, Honan, in 110 A.D. he succeeded his father,
Sze-ma Tan, as grand recorder and astronomer, and took up the historical work begun by him. It was finished in 91 B.C. and was named "Shih," or "Historical Records." It covers the period from 2697 to 104 B.C. He is also noted for reforming the calendar. The chronology settled by him still prevails in China. Consult Giles, H. A., "History of Chinese Literature" (New York 1901), and Hirth, F., "Ancient History of China" (ib. 1911).

SZEBEN, sz'ben, NAGY, nó'd'y, or HERMANNSTADT, hér'män-stät, Rumania, the capital of a county of the same name in Transylvania. It lies amid beautiful surroundings, among which there are several noted health resorts. The city, which is built partly on a hill, partly on a small river-plain, has handsome, well-paved streets and a large market place. Among the principal buildings are a large Gothic church dating from the 13th to the 16th century and now used by a Lutheran congregation, the city hall, the communal hospital, several large barracks and the palace of Bruckenthal containing a library and collections of art and antiques. There are five institutions for higher education in the city, besides a cadet school, trade schools and a number of minor schools. The principal industries are the manufacture of cloth and blankets, soap, spirits, glue and horn articles, and there are many machine shops, tanneries and two large breweries. The inhabitants are chiefly German Protestants. The formerly important trade with the East has declined. Nagy-Szeben was the capital of Transylvania, and from the 15th to the 17th century was very strongly fortified. It was a city of Hungary until under the Peace Treaty of 1919 with part of Transylvania it was included in Rumanian territory. Pop. about 31,000.

SZEGEDIN, szég'éd-én, Hungary, the county of Csongrad, on the 4 miles southeast of Budapest. It is a district. It has suffered the ravages of war, fire, and is now modern in industry and buildings. Its public buildings possessing and include municipal courts, barracks, theatres. The manufacture of paper, liquor, soda, tobacco, coarse wool, salt and tobacco. There is an important trade in wool, cattle, salt and tobacco. Boats are built in the yards of 1526 it was taken by the Turks, until 1686. Pop. 118,300.

SZENTES, sén'tésh, Hu., county of Csongrad on the le. Nearly 29 miles northeast of Theiss, contains many good buildings, a Protestant church with a fine clock, churches and a town house. The trade is based upon corn, cattle and wood, in which large trade as also in wine. It has a station of municipal trams. Pop. 31,590.

SZOLNOK, söl'nök, Hungary, a r., and market town in the county of Ják in the right bank of the Theiss. It is the principal town of the government, a steamboat service on the junction of four railways. Its buildings include a Turkish mosque now used as the ruins of a citadel and a Franciscan convent. It carries on an extensive trade in grain, cattle, salt and wood. Latter it was the scene of a Hungarian rebellion over the Austrians on 5 March, 1848, 28,900.
the 20th letter of the English alphabet and the 16th consonant, is a sharp mute consonant to which d answers as a sonant. Its earliest form both in Greek and Latin was but little different from which it still has; but in some early Etruscan inscriptions it is an s stroke with a small stroke at the top right or left: in early Phoenician Hebrew rock inscriptions it has the form  or  r. t is usually classed as a surd, less dental, but in English pronunciation it is classed with the cerebral, being with the tongue on the hard palate. In and other languages of Continental Europe it is a true dental, for in pronouncing en those languages the tongue comes close to the teeth. The same difference between English and those other lan- in the pronunciation of d. The digraph th, which in English, namely, the voice- nal fricative value which it has in throw, and the voiced dental fricative  that, then: these two sounds were rep- in the Anglo-Saxon alphabet by two characters, namely  for th in thank, and  for th in this, that: but in Old manuscripts there was little consist- ty the employment of these characters. Variations of the Irish pronunciation of rath the in thin, thorn, through, etc., is aspirate rather than a fricative, the tip of the tongue is pressed against the upper and the breath emitted with force; but in the English pronunciation of th is brought against the back of the teeth, with very slight contact, and the emitted between tongue and teeth; and: a similar difference between the Irish English pronunciation of th in that, then,  and in the Irish pronunciation the tongue is in full contact with the teeth. Th, or the diphthongal u (as in use), has the of th th, nature, natshur.—In the corre- of English and the languages it there is interchange of t with other examples: Eng. three, Ger. drei, Goth. Lat. tres, Gr. treis; Eng. thath, Ger. Lat. tectum, Gr. tegos; Eng. brother, ruder, Goth. brother, Lat. frater; Eng. th, than; Eng. thank, Ger. Dank. Very  t in an English word is represented by z kindred German word: Eng. two, Ger. zwei, toll; Ger. Zoll.

T

TETRANITROANILINE. Flàrschen, who, in 1910, proposed to use it as a commercial explosive as it was more powerful than any substance then in use, manufactured it from commercial dinitrobenzene by treating the latter with a solution of potassium nitrate, then nitration the product thus obtained with mixed acids at 20° C., or lower. The TNA separated in yellow crystals which when washed and dried had a specific gravity of 1.867 and, when heated at the rate of 5° C. per minute, a melting point of 216° C. and an explosion point of 200° C. Its rate of detonation is 5,500 meters per second. It is an efficient agent for re-enforcing detonators and as a booster, but its stability is questioned.

TNT or TRINITROTOLUENE. See TRINITROTOLUENE.

TNX, an explosive substance having the formula (CH₃)₃C(NO₂)₃ and whose scientific name is trinitroxylene. It is produced by nitrating the aromatic hydrocarbon known as xylene with mixed acids and fuming nitric acid. Several different compounds having the same percentage and radical composition may be formed, but the one produced in largest amount and the one most sought is the trinitrometaxyylene. This when pure crystallizes from alcohol with milk-white lamellas which when slowly heated melts at 176°-177° C. TNTX is used either alone or in admixture with ammonium nitrate, as a bursting charge for high explosive shells. It has also been used as a component of blasting explosives such as monachite.

T-RAIL. See Rails and Structural Shapes, Manufacture of.

T-SQUARE, a ruler used by draftsmen, made similar to the common L-shaped square, but of wood, and in the form of a T. It is often graduated in the edges and is convenient for ruling lines at right angles to a base. Sometimes the long arm is made adjustable, so that it may also be used for drawing angles.

TA-KU, tā'koo', China, a small fortified town situated near the head of the Gulf of Pe-chi-li, southeast of Tien-ting, and about 80 miles southeast of Peking. It is important as guarding the entrance to the Yung-ting River. It has been the scene of several engagements and was captured by the Allies in 1900, and after the war remained garrisoned by German troops.

TA-LIEN-WAN, tā'lēn wān', Manchuria, a bay on the east side of the extremity of the Liao-tung Peninsula, about 40 miles northeast of Port Arthur. The British fleet occupied it in 1860. It is within the territory leased to Russia in 1898. At its head is the northern port of Dalny (q.v.) which was opened to

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foreign trade in 1901. The construction of a Russian naval station was well advanced when the Russo-Japanese War broke out in 1904 and the bay became the scene of war operations. The adjoining territory passed to Japan in 1905.

**TAAFFE,** tā'fē, Eduard Francis Joseph von (1806-1888); statesman: b. Prague, 24 Feb. 1833; d. Ellisbach, 29 Nov. 1895. He was of Irish descent and a Baron of Ballymote as well as Viscount of Austria; was educated at the University of Vienna and entered the civil service. Promotion followed rapidly and in 1867 he became Minister of the Interior. In the following year he also served as acting Minister-President. He had entered politics as a German liberal, but manifested a growing tendency toward Federalism, which he regarded as the only means of reconciling warring factions. In 1870 he joined with two of his colleagues in urging upon the emperor a policy in the direction of Federalism with autonomy, but being defeated in this endeavor, he resigned. In 1871 he became governor of Tyrol and Vorarlberg. In 1879 he was again made Minister of the Interior, formed a new Cabinet and remained at its head until 1893. Devotion to the cause of the emperor was Taaffe's strongest trait, and as this involved the consideration of the anti-Catholic nationalities of Austria, he bent every effort in that direction. He worked not through one party, but with any party which by opportune measures could be brought to support his policy, and he relied mainly upon private efforts, for in public he was an inferior speaker. In 1893 he was defeated in his purpose to extend the franchise and his retirement from public life directly followed.

**TAAAL,** tā'äl', Philippines, pueblo, province of Batangas, Luzon, on Balayan Bay at the mouth of the Pasig River, 13 miles north-west of Batangas, and about 50 miles south of Manila. It is named after an older town on Lake Taal that was destroyed in the volcanic disturbances of 1754. The people are mostly Tagalogs and are connected with Batangas and other towns by highway, has a well-sheltered anchorage and carries on an important coastwise trade. Agriculture, stock-raising and fishing are also important industries of which Taal is the centre, and sulphur deposits are found in the vicinity. The town is well built on a terraced hill, is an important military station and one of the largest municipalities in the province. It has good schools. Pop. about 36,000.

**TAAAL,** Philippines, a lake. See BOMBON.

**TAAAL,** Philippines, a volcano on Bombo Island in Lake Bombo or Taal, province of Batangas, Luzon, about 40 miles south of Manila. The island from which it rises is 14 miles in circumference; its greatest height is to the southwest, 1,067 feet above the level of the lake; from this point it descends and then rises to a height of 780 feet to the north. The crater is oval and the walls steep; at the bottom of the depression lies a lake; it supplies large quantities of water. The last eruption recorded took place in 1911; eruptions also occurred in 1709, 1715, 1716, 1731, 1747, 1754, 1808, 1873 and 1911.

**TABACO,** tā-bä'kō, pueblo, prov. Albay, Luzon, on Tabaco Bay, east 10 miles north of Albay, the provincial capital. It has the deepest and best-sheltered port in the province and carries on a large trade. It is the third port in Albay in importance of its shipping. Pop. about 3,000.

**TABARD,** in the times of the 1 tunic-like garment, worn over the arming the body before and behind and below the loins, but open at the shoulders downward; it had long slits in the sides reaching to the elbow and yokes embroidered with the arms of the sovereign.

**TABARI,** tā-bā'ri, Abu Jafar Ibn Djeurir, Mohammedan theologian: b. Amul, Taberistan, 837; d. 923. During the first half of his life he was the area of his learning and expatriate traveling from one centre to another of religion and speculation between Asia and Egypt, devoting himself to the study of the Koran and the acquisition of lore which jurisprudence, tradition, his philology had contributed to the Mohammedan scriptures. In a he settled at Balkh, and in the latter part of his investigation as a teacher and in Arabic. His principal works are the or (Exegesis), which contains a collection of the existing independent commentaries of all interpreters of the Koran, large additions, original and compiled by Al-Razi. It filled 25 large volumes and was published in 15 volumes the Zeitschrift der Deutschen Morgenländischen Gesellschaft (1881). His other somewhat less important, being a hit the world ("Annals") from creation to

**TABASCO,** tā-bä'skō, Mexico, a state at the head of the Gulf of Campeche. It is one of the states of the Confederation, its are 10,072 square miles. The surface is most entirely of a great flat, sloping to the sea, but in many parts so low subject to inundations. The streams, numerous, are short and shallow and greatly obstructed at their mouths by bars. The Tabasco, or Gisalva, River, is navigable for 90 miles and the Usumacinta to 175 miles. The climate is excessively particularly along the coast, and in the interior it is very unhealthy. A large portion of the state is still covered with primeval forest. The principal cultivated crops are cacao, dye-woods, vanilla, indigo, tobacco and the inhabitants are chiefly Indians. Th is San Juan Baptista. Pop. of the state 191,000.

**TABSHEER,** or TASAHSIR markable substance occasionally found hollow joints of certain species of bambo other large grasses. It is ordinarily for by splitting open the bamboo stem give a rattling sound when shaken. It is especially used to be found in the Bambusa and other related of Japan, China, Java and the Andes
tains. During the rapid growth of the bamboo shoots, their solid joints become hollow and are partially filled with water containing silica in solution. The development of the foliage leads to active transpiration; the water absorbed from the soil quickly disappears and tabasheer is the residue. It is at first jelly-like, but gradually solidifies into small milky-white masses. Physically and chemically these are practically identical with the hydrophane variety of the mineral opal. It is an open question whether tabasheer should be registered as belonging to the mineral or the vegetable kingdom. It is essentially a hydrous silica, the lime and potash which are often present being doubtless simply impurities. Its optical properties are most remarkable. According to Brewster, it has a lower index of refraction than any other solid or liquid, its refractive power being not only lower than water, but so much lower as to be almost intermediate between water and air. The history of its opalescent and remarkably phosphorescent. It becomes transparent when saturated with water and is remarkably porous. It probably possesses greater absorptive power than any other mineral, because the pores occupy two and one-half times as much space as the silica itself, notwithstanding the fact that they are invisible even under very high powers of the microscope. From time immemorial it has been highly esteemed for its supposed medicinal properties. A knowledge of the substance was introduced into Europe by the Arabian physicians and its name is of Arabic origin. Much so-called tabasheer in Turkey and Asia Minor is artificial. Consult Nature (Vol. XXXV, p. 488, 1897).

TABB, John Banister, American poet: b. Amelia County, Va., 22 March 1845; d. 1909. After private study, he was appointed in 1862 captain's clerk to the Confederate blockade-runner R. E. Lee, but in 1864 he was captured and held prisoner for seven months at Point Lookout, Md. He studied music in Baltimore, taught there, and at Racine College, Michigan, and after courses at Saint Charles College, Ellicott City, Md., and Saint Mary's Seminary, Baltimore, was ordained in 1884 to the priesthood of the Roman Catholic Church. Later he was professor of English at Saint Charles. He privately printed a book of 'Poems' (1884), and from that time wrote largely for the magazines, gathering his contributions at intervals into various collections. His volumes are: 'Poems'; 'Lyrics'; 'An Octave to Mary'; 'Rules of English Grammar'; 'Poems Grave and Gay' (1899) 'Two Lyrics' (1900) 'Later Poems' (1910). Ingenious in matter, compact in form, his length is the quairain distinguished by an effectively simple diction.

TABBY, a variety of rich watered silk which has undergone the operation of tabbying or being passed through a calander, the rolls of which are made of iron or copper variously figured, which, bearing unequally on the stuff, renders the surface unequal, so as to reflect the rays of light differently, making the representation of waves thereon.

TABBYTE, a variety of asphalt, semi-brittle, semi-waxy, containing a small percentage of ceresin; readily fusible, freely soluble in carbon disulphide; used in making paint, varnish, rubber substitute and pavings. Occurs with other bitumens in Wasatch County, Utah.

TABERNACLE (from Lat. tabernaculum, a tent), the tent in which the Ark of the Covenant was deposited during the wanderings of the Israelites in the wilderness, and subsequently in Palestine until the erection of a permanent building at Shiloh. When this building was erected does not appear in the Scriptures, but 1 Samuel iii, 3, clearly shows that it existed in the early days of the prophet. The building in which the Ark was is there spoken of as a temple. The sanctity which attached to the Jewish tabernacle led to the use of the word by Christians to designate places considered peculiarly sacred and in the Roman Catholic Church the name is given to the receptacle in which the consecrated elements of the Eucharist are retained. This is a small structure of marble, metal or wood, placed over the high altar and reserved exclusively for the Eucharist. Tabernacle is also in occasional use as a designation of Protestant churches. See Ark; Pyx.

TABERNACLES, Feast of, one of the solemn yearly feasts of Israel, directed by the Lord, as set forth in Leviticus, ch. xxiii. It is there commanded that the 15th day of the 7th month shall be the Feast of Tabernacles, to last for seven days. On the first day there should be a holy convocation and no service work should be done therein. Seven days ye shall offer an offering made by fire unto the Lord; on the eighth day shall be a holy convocation unto you, and ye shall offer an offering made by fire unto the Lord: it is a solemn assembly, and ye shall do no servile work therein. The Israelites were further directed to take boughs and branches of trees and willows and to dwell in booths seven days, to remind them of the time when they dwelt in booths in the exodus from Egypt. All orthodox Hebrews observe the Feast of the Tabernacles, which comes in the latter part of September. See Jews and Judaism.

TABES DORSALIS, an affection of the nervous system akin to locomotor ataxia and paralysis. It is characterized by a lack of power in harmonizing the action of certain muscles, the absence of such co-ordinating power being apparent first in the lower extremities, making the gait staggering and unsteady. There is no true paralysis, but sensiveness is diminished; the loss of power proceeds and the later stages of the malady are marked by such symptoms as disordered vision, incontinence of urine and exhaustion. The duration of the disease varies from a few months to several years. Its causes are obscure. A peculiar change in the posterior columns of the spinal cord and in the posterior or sensory roots of the spinal nerves accompanies it. Prolonged exposure to cold, damp, drunkenness, sexual excesses, masturbation, etc., have been regarded as causes. Many authorities believe that it is, in many instances, or even exclusively, a remote result of syphilis. It is alleged to be more common in men than in women and subjects between the ages of 20 and 50 are said to be most liable to it. The patient has an unsteady gait and walks like a drunken person, but soon recovers his bear-
ing in some degree. A difficulty in carrying out the intents of the will is experienced and in picking up an object one hand is employed to steady the other. When the eyes are shut the patient walks with extreme difficulty. Tabes dorsalis may be distinguished from disease of the cerebellum by absence of the characteristic pain at the back of the head, and of vomiting. The progress of the disease may be retarded, but the prospect of cure is nearly hopeless.

The treatment is limited to improvement of the general health: warm clothing, nutritious food and rest are the chief items. Salvarsan is sometimes injected directly into the spinal column with good results. Consult Osler, William, 'Practice of Medicine' (New York 1912).

TABLAS, ti'biyas, Philippines, the largest and most western island of Romblon province, 15 miles north of the island of Panay; length, north and south, 40 miles; width, 13 miles; area, 325 square miles. The island is mountainous; the highest peak, in the extreme north east, has an elevation of 2,405 feet; the coasts are mostly abrupt; on the west coast are several good anchorages for small craft; Loog has the best harbor. There are no good roads and few trails; communication between the towns, which are all on the coast, is by sea.

The chief industries are agriculture, stock-raising and fishing; but these are almost entirely for domestic purposes. The island is heavily wooded, but lack of communication with larger islands has prevented the development of the forest resources. Pop. about 26,000.

TABLE-LAND, or PLATEAU, an elevated flat tract of country of considerable area. In ordinary usage the term is applied to such flat areas elevated above 1,000 feet from sea-level. The level character of the plateau may be due to the horizontality of the strata composing it, the surface being formed by a resistant stratum, or it may be due to subaerial or marine denudation of a flexed and folded mountain belt, erosion having proceeded so far as to reduce the region to a nearly level tract or peneplain, which is then elevated bodily.

Any portion of the ancient mountain system not worn away will rise as a peak or mountain range above the peneplain surface, and constitute a monadnock. A plateau of this type—that is, an elevated peneplain—may be readily recognized by the disappearance of the slope of the strata composing it with the level surface of the peneplain, the two not infrequently making an angle of 90 degrees with each other. When a young plain of deposition with horizontal strata is elevated into a plateau, and the rivers begin to cut their channels down into it, it is in the beginning of its first geographic cycle. If it remains stationary at the altitude to which it was raised, the rivers will eventually seize their channels to such a depth that their bed from ocean to head is almost perfectly graded. Then lateral erosion will widen the valley bottoms, and reduce the portions of the plateau between the river valleys until finally these separating remnants of the plateau have dwindled to such an extent that they appear as ridges or peaks rising from a level plain, which latter is the modern plateau. If the river valleys cut into the former plateau. This is the beginning of the peneplain stage, and continued erosion will bring the surface nearest to a perfect plain not far above sea-level. If this is reached, the first cycle of geographic development is complete. The second cycle is inaugurated by a re-elevation of the land into a new plateau, when the whole process will be repeated. In like manner a folded mountain region may be worn down to a peneplain, and re-elevated to enter upon the next cycle of erosion. Most plateaus are probably elevated peneplains, either of horizontal strata or of more or less strongly folded and truncated strata. Into these the present drainage has incised itself more or less successfully. Thus the New England region is a peneplain plateau, of inclined strata, whose surface, moderately dissected by streams, slopes gently toward the coast. Southern New York, western Pennsylvania, Ohio and other districts are part of a plateau in which the strata are nearly horizontal and which has been more or less strongly dissected. This extends from the upper Tennessee where it is known as the Cumberland plateau. It is probably past its first cycle of erosion, and appears to have been a peneplain.

Among other noteworthy plateaus of North America are the High Plains of southern Utah, which range in elevations from 7,000 to 9,500 feet above the sea, their elevation being connected with that of the Wasatch Range of mountains. Between the Rocky and Sierra mountains extends a broad plateau from Mexico northward through British America. It averages from 3,000 to 5,000 feet in elevation, and is deeply dissected by the canons of the Colorado, the Columbia and other rivers. The portion included between the two rivers named is called the Great Basin. It is bounded on the east by the Wasatch Mountains, and on the west by the Sierra Nevada and Cascade ranges, and has a width of nearly 500 miles, with an elevation of 4,000 to 5,000 feet. It has no outside drainage, and hence the streams are short, and the water bodies saline. Great Salt Lake and Mono Lake in California are respectively on the eastern and western side of this plateau, and the surface between is arid and more or less desert. Similar conditions exist in the Mexican extension of this type of table-land—to which the name intermont plateau has been applied—is found in the great plateau of Tibet between the Himalayas and the Kuen-lun Mountains. Its altitude is about 13,000 feet, while the enclosing mountains rise from 25,000 to 29,000 feet in height. It is 1,200 miles long from east to west, and half as wide. The plateau of Quirao is 10,000 feet above sea-level and surrounded by lofty peaks rising 30,000 feet or more. That of Bolivia has an elevation of 12,000 feet with Lake Titicaca at 12,830 feet, and the city of Potosi at 13,330 feet elevation.

The plateau of Spain averages 2,250 feet in elevation, that of Auvergne, in France, about 1,100 feet. Bavaria is a plateau rising 1,100 feet. Persia is another from 2,000 to 4,000 feet above the sea. The Abyssinian plateau in Africa averages 7,000 feet above the sea, while much of the Sahara region is about 1,500 feet above sea-level. The table-land character of all these regions is marked. Owing to the dissection of the plateaus they appear as a rule anything but level to the traveler.
TABLE LAWN-TENNIS — TABOO

A comprehensive view from a summit is 1. Many of the larger plateaus are also
3 BLE LAWN-TENNIS. — See Ping-
3 BLE MOUNTAIN, Cape Colony, Af-
flat-topped mountain with nearly per-
lar sides, situated just south of Cape
Its height is 3,540 feet.
3 BLE TURNING, in psychical phen-
the turning or movement of a table at a
usually at gatherings of believers in
manifestations. A number of persons
round a table, on which their
chel fingers lightly rest. They assume
posting state, usually sitting in a dim light,
etimes listening to soft music. After
the table begins to move, and on some as
to answer questions either by tilting
at appropriate letters as the alphabet
repeated. Faraday was of opinion that
y suppose was unduly impressed table by those who stood around it, and
been pointed out that pushing may take
out any distinct consciousness on the
those who push, and that expectant at
is known to produce such a state of the
as would occasion this unconscious
The principle involved is the same as
chant and the ouija board, and has been
ated exhaustively by the Psychical Re-
Society. Consult Podmore, F. W. Modern
ism' (London 1902). See SPIRITUAL-
BLEAUX VIVANTS, tābā'ā vē'vān
a 'living pictures'), are representations
es from history or fiction by means of
of grouped in the proper manner, placed
propriate postures, and remaining silent,
ere supposed to have been first introduced
lame de Genlis, instructress of the
child the Duke of Orleans.
BLES, Lunar. See LUNAR TABLES.
3 LINUS, in Roman antiquity, an apart-
 a house in which were deposited the
and records and archives, and all docu-
memorating the exploits which had
formed by members of the family, or
ere connected with the high offices
y of them had filled. It was usually
opposite to the entrance.
3 QO, or TABU, a word of very ex-
meaning used by South Sea Islanders, to
something consecrated, sacred, forbid-
be touched, or set aside for particular
persons. It is applied both to persons,
and both to the object prohibited the
persons against whom the prohibi-
tends. Thus a consecrated piece of
is taboo, the act of consecrating it is
hoo, and the persons who are excluded
tering are also said to be tabooed. It
among certain tribes, for example, the
body of a chief living or dead, or
belonging to him; to eat in his pres-
anything he has touched; to cross his
otherwise than on the hands or
r a fish from which the eaters of
food is sometimes tabooed at a cer-
son in order to preserve it against a
of scarcity, etc. In the case of a serious
ment of the taboo the punishment is
death; in less heinous cases a sort of outlawry,
the neighbors being permitted to appropriate
or destroy the offender's goods.
The word "taboo" has been adopted into
English to designate similar customs among
ances, apart from those from which the term
was derived; and has assumed a coloquial sense
which is altogether non-religious and negative,
though the word was originally used more to
designate definite religious ceremonies that were
obligatory upon the tribe or upon the individ-
uals composing it. These taboos may be
erved at certain stated times and under cer-
t conditions, generally in connection with
important undertakings. In many Indian tribes
of America, the warrior who succeeded in kill-
ing an enemy was required, on his return to
home, to undergo certain purification cere-
monies before he could again resume his former
relations with the members of his tribe. Until
these ceremonies had been performed, not only
were these former relationships tabooed to him,
but he himself tabooed to the tribe; and
any one violating the conditions of the taboo
became himself tabooed. Always during the
period of duration of the taboo, the individual
or individuals subject to it are denied the exer-
cise of certain privileges; they may be
temporary or permanent; it may be ceremonial,
belonging to a fixed and definite period in life,
or it may be occasional. Most ancient races
had a particular taboo connected with birth,
puberty, marriage, death, and other times with
periods previous to birth and after death; with the
assumption of public office and with almost every
undertaking in life. Probably most of these
customs had their origin in the fear of the
superior power of certain deities or evil-dis-
opposed spirits and a desire to propitiate them.
But in time many of them came to be of a
more or less religious and formal nature, and
thus many religious observances were formerly
 taboo in character. Very numerous are the
things which have been subject to taboo; but
they may be classed under a few more or less
definite heads of a general nature. These in-
clude objects unclean in their nature, or through
mythical, superstitious or religious association;
ings supposed to belong to, in contact with,
or to be influenced by spirits or beings feared on account of their mysterious power;
strange or unknown objects or customs which
it is the part of good sense to propitiate before-
hand in case they should prove powerful and
ill-disposed. The dread power of priests and
rulers was especially feared for it was held lit-
tle inferior, if any, to that of ghosts, witches,
and the supernatural people in general, and
superstitious animals.
Opposed to those taboos of fear were those
inspired by a desire of personal advantage. Of
this nature were the offerings and prayers of
household gods and to certain deities
before undertaking any enterprise of a personal
nature. The priest, the ruler, the representative of
the tribe or the nation, performed the same
 ceremonies for them and with the same end in
view. In connection with these ceremonies
there were certain taboos. On opening a cask
or bag of wine, the first handful was only given
to all but the gods of growth and fertility who
made the production of the wine possible. The
firstlings of the flock were given to the protec-
tor of the herds, the ancient god of hunt-
ing; the first fish caught by the fisherman, the first game taken by the hunter, the first ripe fruit and vegetables grown by the husbandman were tabooed for a time, for the benefit of the possessor. There was not a movement or interest in life without its taboo of a similar nature. Not infrequently the two ruling motives of fear and hope of personal gain are found combined in the same taboo, for a much feared and punished sin, or one superior being might, if propitiated, become a valuable ally and helper in time of need.

Taboo associations had much to do with totems and every totem had its taboo. Among many American Indian tribes, a hunter might not kill the animal represented by his totem. Among certain others, only a part of such animal was tabooed. The moon being the goddess of fertility, her power was greatest when her full face looked toward the earth. Hence among many races, the planting of grain was tabooed except at the full of the moon. Yet potatoes and bulbous plants could be planted only when she showed the least of her face, for it was feared she might make the part above the ground grow at the expense of that beneath it. Among the forest tribes of the eastern United States and Canada, the killing of the ground squirrel was tabooed because he was credited with the discovery of medicines or their introduction to man. Among the Algonquins the white rabbit was tabooed for the hunter because the great culture god Nanabozho frequently assumed the form of a white rabbit. The white dog could not be eaten by the plains Indian because he was reserved as an offering to the great spirit. Among many primitive peoples, the names of the dead were tabooed for a certain length of time lest the pronouncing of them might call their spirits back to earth to incite them to unfriendly action. To such a length was this fear of the dead carried that some tribes buried the name with the departed and in its place bestowed another by which the dead was afterward referred to and remembered. Sometimes taboos were as wide as the tribe or the nation; and many of these ancient taboos have survived in the shape of national feeling against the use of certain objects.

The custom of making certain places sacred to certain deities arose out of the practice of setting apart such places for the worship of these deities, or through the fact that certain places were believed to be the abode of all powerful beings. This belief tabooed such places to all but the powerful beings who it was claimed had already pre-empted them. (See Nature Worship; American Mythology.) Consult Bancroft, 'Native Races' (New York); Frazer, J. G., 'The Golden Bough' (London and New York 1907-13); Gennep, 'Talou et totemisme a Madagascar' (Paris 1948); W. Albrecht, 'Anthropologie der Natur-Völker'; Smith, W. R., 'Lectures on the Religion of the Semites' (New York 1907); Summer, W. G., 'Folkways' (Boston 1907); Taylor, 'Te Ika A Maui, or New Zealand and its Inhabitants' (London 1870).

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TABOR, Horace Austin Warner, American miner and capitalist; b. Holland, Vt., Nov. 1830; d. Denver, Colo., 10 Apr. He learned the stonecutter's trade in his youth; removed to Kansas in 1855, 12 years later to Colorado, where he himself discovered California Gulch, a place he later named. In 1878 he with his partners struck the gold of silver in the mine in 10 years. He was mayor of Leadville and gave large sums to public buildings. Leadville, accordingly, hardly more than a month ago, was an opera house costing $500,000. In 1885 he was elected lieutenant-governor of Colorado and from February to March 1885 was a States senator in place of Henry M. Teller who entered the Cabinet. From that time fortunes began to decline and by 1897 tire accumulations had been swept away and returned to mining on a small scale. 1896 was made postmaster of Denver.

TABOR, Palestine, now called Jebel al-Arak, eight miles east of Nazareth, is in the shape of an almost square hill, the northeastern arm of the plain of Jezreel a height of nearly 1,000 feet, or 1,200 above sea-level. It is well-wooded; the green of the walnut, the rose bushes, the low white styrax blossoms, the pista oak trees—all these and many others—fying the path to the summit, where a gaze from the crown of the mountain, is a panorama of wolves, wild boars, lynxes, and reptiles. The isolation of this mountain was due to its being made by the clefts in the rock that characterize the scene of the Transfiguration. The data, however, shows that the mountain was occupied as a stronghold from the time of the Antiochus Magnus (218 B.C.) until the extent of Jerusalem under Vespasian. Natural remains still exist on the summit. Baedeker, 'Palestine and Syria.'

TABOR COLLEGE, located at Cedar Rapids, Iowa. It was chartered in 1854 as a Literary Institute, and an academic course was opened in 1857; the collegiate department was established and the name changed to College in 1866. It is non-sectarian in its beliefs, and owes its foundation and support to the Congregationalists, and is endorsed by the Congregational Conference of Iowa. The curriculum comprises the *classics, science, and arts. Diplomas are granted in the ba.

TABORITES, a group of the followers of the 18th-century German Protestant John Huss, who was condemned as a heretic by the Council of Constance, and had the stake, 6 July 1415, and his ashes thrown into the river Rhine. Others of the
as Hussites. These exasperated fol-
look cruel revenge on priests and monks
Church. King Wenceslaus of Bohemia
them by granting them religious free-
the use of some of the churches.
the death of the king in 1419, the Pope
command for the conversion or sup-
sof the Hussites, and the latter took up
nd assembled under the leadership of
iska on Mount Tabor. They captured
burned the monasteries and defeated
erial troops. Their success was con-
for about 15 years until the division be-
more radical branch known as Tabor-
o acknowledged the Scriptures as the
ource of authority, and the Calixtines,
ated to Roman Catholic principles of
s eac h a c t e. The Calixtines came to an
ading with Rome, and the Taborites,
fight alone, were signally defeated in
the struggle with the empire terminated,
r, in the concession of civil and reli-
g to Bohemia by the Emperor Sigismund
 but civil war raged at intervals in Bo-
ntil 1485, when King Ladislas confirmed
ermal grant. See HUSS, JOHN.
BRIZ, tā-brēz', or TAUVRI, tā-vrēs',
 a city in the extreme northwest, about
s, from the Russian border, capital of
ince of Azerbaijan, on the left bank of
. 36 miles above its entrance into Lake
is situated at the inner extremity
phitheatre, about 4,000 feet above sea-
with hills on three sides, and an exten-
 on the fourth. It is surrounded with
of sun-dried brick, with bastions, and is
by seven or eight gates. A large por-
the population resides outside the walls,
plain around is covered with gardens,
ng the finest fruits in great abundance,
early grapes. The citadel is the most
uous building in the city. It was origi-
mosque, and is 600 years old. It con-
 a lofty edifice of brick, and though
amaged by earthquakes, is still a noble
re. Within the walls of the citadel there
annon-foundry and barracks. The most
building in the town is the fine ruin
musque (B. Jewish Mosque), which is about
rs old, and is partly covered with ara-
tiles. A considerable trade is carried
import of European goods and sugar,
er consisting mostly of cotton manu-
, principally British, petroleum from
and woolen goods, chiefly from Austria,
ance; and in the export of raisins and
uits, leather, carpet, silks, skins, cottons,
tea, etc., principally to Russia and Tur-
The imports and exports in normal years
over $10,000,000. Though still a com-
city, Tabriz has diminished in import-
what it was in ancient times; the
ations of old travelers, who speak of its
cafés and its hundreds of caravanser-
, being no longer applicable; its
and demand for speculation had ed to
about 165,000 in 1881, although in
imated at 200,000. The city has been
dly devastated by earthquakes, the mos
give being those of the years 858, 1041
21; on one last occasion 80,000 persons
posed to have perished. During the
World War the city was occupied first by
the Turks and later by the Russians.
TABULAR STANDARD OF VALUE,
a project for giving fixity to the value of money
by varying from time to time the amounts of
 gold to be paid according to the changes in its
purchasing power. The practical object which
those who advocate the adoption of this stand-
ard of value proposed is the attainment of a per-
factly stable currency for the payment of rents
or other deferred contracts. A tabular stand-
ard, therefore, if adopted would be simply an
fixed index number. (See INDEX NUMBER). Ac-
According to Jevons it is proposed that a con-
siderable number of commodities, say 100,
should be chosen with special regard to
the independence of their fluctuations one
from another, and then the geometrical average
of the ratios in which their gold prices have
changed would be calculated logarithmically.
The system involves the proposition that these
average prices should constitute the legal
standard for settling contracts expressed in
money—thus, if a note was signed in 1915
pledging the payment of $1,000 in gold in
1920, and it appeared that in 1920 that $1,000 would
then buy upon the average of all commodities
one-fourth less than it would have bought in
1915, the debtor should be compelled to pay
$1,333 to the creditor in 1920 in full satisfaction
of the debt; since in 1920 the sum of $1,333
will purchase only what $1,000 would purchase in
1915. It is claimed by its advocates that such
a standard would add a wholly new de-
gree of stability to social relations, securing the
fixed incomes of individuals and public institu-
tions from the depreciation which they have
often suffered. Speculation, too, based upon the
frequent oscillations of prices, which take place
in the present state of commerce, would to a
large extent be discouraged. The great obstacle
to its adoption is the difficulty of getting
economists to agree upon the precise manner of
fixing the standard and calculating the averages
of the several commodities, and even agreeing
upon the inclusion of the latter. The idea of
the tabular standard appears to be due to Sir
George Evelyn who advocated "a standard of
Weights and Measures" before the Royal So-
ciety in 1798. Joseph Lowe further elaborated
the idea in 1823 in his "Present State of Eng-
l." Scrope followed Lowe and nearly all
the economists of the 19th century were interested
in the tabular standard. W. S. Jevons brought
the matter into prominence in 1865, and further
elaborated it in his later works. Consult
Palgrave, "Dictionary of Political Economy";
Anderson, B. M. "The Value of Money" (New
York 1917); Price, "Money and its Relation to
Prices" (London 1896); Walker, "Money"
(New York 1878).
TABULARIUM, in Roman antiquity, a de-
pository of public records; specifically, a build-
ing for the preservation of such records which
stood on the slope of the Capitoline Hill facing the Forum. It was built (78 A.C.)
by the consul Quintus Lutatius Catulus. The
masonry of many of its great vaults and
columns is still intact, although another structure
has been erected on the old walls.
TACAMAHAHAC, the name of various oleo-
resins allied to elemi, exuded by different spe-

cies of trees. East Indian tacamahac, yielded by Calophyllum inophyllum of Réunion and Madagascar, is a dark-green balsamic resin of specific gravity 1.032, melting at 75° C. A yellow variety is produced by an African tree (Amyris tacamahac), and another kind comes from the Brazilian Icaca heptaphylla. The balsam poplar (Populus balsamifera) of the United States yields a similar resin.

TACANÁ, Guatemala, a volcano on the Mexican frontier, which rises to a height of 12,400 feet. It is one of several neighboring volcanic peaks of the Cordilleras, and is second in height to Tajumulco which reaches an elevation of 12,600 feet.

TACCA, the typical genus of the family Taccaaeae. It is represented by perennial herbs with tuberous or creeping rootstocks, large radical leaves, and dense umbels of flowers, brown, purple, or greenish in hue. These terminate a naked scape and have an involucre of bracts, the inner being filiform and pendulous, the outer herbaceous or colored. The fruit is a berry, usually three-angled or six-ribbed. Tacca spathacea, or clump, is found in Polynesia and southeastern Asia. It is a low plant, with dissected horizontal leaves and an umbel of greenish flowers.

TACHÉ, Alexandre Antonin, Canadian Roman Catholic archbishop: b. Rivière-du-Loup, Quebec, 23 July 1823; d. Winnipeg, Manitoba, 22 June 1894. After graduating from the College of Saint Hyacinth and studying theology at Montreal, he became a member of the Order of the Oblate Fathers. He then started out as a missionary for the Northwest and there began the charitable work among the Indians of the Red River country which made him famous. He was consecrated (1850) bishop of Arath, and (1863) bishop of Saint Boniface. When the bishopric of Saint Boniface became a metropolitan see in 1871 Taché was appointed its first archbishop. In 1870 while bishop of Saint Boniface at the urgent request of the Canadian government, he performed the service of pacifying the Metis of Manitoba, who had rebelled. Among his publications are: 'Vingt ans de missions dans le nord-ouest de l'Amerique' (1866); 'Esquisse sur le nord-ouest de l'Amerique' (1896), etc.

TACHÉ, Sir Etienne Paschal, Canadian politician: b. Saint Thomas, Quebec, 5 Sept. 1795; d. there, 29 July 1865. He practised medicine until 1841, when he became a member of Parliament; from 1848-49 was commissioner of public works; and from 1856-57 was speaker of the legislative council. He published 'Le developpement de la force physique chez l'homme' (1829); 'Reflexions sur l'organisatios des volontaires' (1863).

TACHEOMETRY, tâk-e-im'-etr, quick measuring, applied in surveying to a method which does away with the practice of measuring distances by a chain or tape-line and ascertaining their position by an instrument, the relative position, both horizontal and vertical, of points on the earth's surface being determined by one observation. A theodolite, or a specially constructed tachometer, of which a telescope is an important part, is employed, and along with it a staff similar to a leveling-staff, 12 feet or so in length, and marked. See Surveying.

TACHINA-FLIES, flies of the Tachinidae, a large and important group comprising house flies and noted for their feeding habits. They may at first seem rather large and gray, more or less the wings clear, the bodies bristle; and disposition to fly in the sunshine with a noise. All are parasitic and are especialy of laying their eggs upon the backs of other insects. For many insects the life of these flies consult Howard, 'The Book' (New York 1901), and the species there cited.

TACHYGRAPHY. See St.

TACITUS, tâs'-tûs, Roman emperor: b. about A.D. 56, at Cappadocia, April 27. He was descended from Tacitus, the historian, whose works he edited in all the public libraries and caused to be transcribed 10 times a year at his charge. On the death of Aurelian he was to be emperor by the Senate, although his will (275) had named the emperor the supreme council by his wish for moderation. During his short reign he ''scribed many needed reforms and end to restore the power of the Senate. Age of 75 he undertook a campaign against Alani, assuming after his victory "Gothicus Maximus." He was assassinated in 276. His own unbridled soldiers; his bro- anus Tacitus, who succeeded him, shared his fate.

TACITUS, Publius Cornelius, in ment of many competent critics, Roman historian. Neither the time place of his birth is known, but eidents in his own works and in the letters of younger Pliny (the two chief sources of information about him) make it probable ber was born about 55 A.D. His educa and political career all point to equestrian rank, and his father was probably that Cornelius Tacitus who, ing to the elder Pliny ("Natural History" 76), was procurator of Gallia Belgica. mired in 78 the daughter of Gnaeus Fulciola, the illustrious governor of Brazil, enjoyed the official favor of Tiberius Titus, and, at least at first, of Domitian whom, in the year 88, he presided as and as a member of the ancient college of Quindicemviri at the celebration of the games. After his praetorship, he was years absent from the capital, and prevented from being present at the d of Agricola, which took place in Rome. During these years he was probably a pratorian legate in a province, and gained at this time some personal known. In 97 (possibly 94) he was consul to succeed Verginius Rufus, o pronounced an eloquent funeral ora was an intimate friend of the younger years his patron, and was deceased, in 100, in the successful prosecution of Marius Priscus, accused of extortion in the province of Africa. According to an nion discovered in 1890 at Mylasa, i Tacitus reached, perhaps in the year the highest post open to a senator, t
ship of Asia. The date of his death is
unknown, but, inasmuch as the extension of
empire to the Persian Gulf, which was ac-
quired by Trajan in 115–16, is mentioned
in Vol. II, 61, and several years were
nearly required for the completion of that
empire, he may have lived into the reign of
Nerva, which began 117 A.D.
The earliest work is the 'Dialogus de Ora-
sis,' written probably under Titus, 79–81.
The scene of the conversation is laid in
the house of a poet Maternus, in the year 74–75,
and a charming discussion of the relative merits
of poetry and oratory leads up to the main
theme, the decline of eloquence in modern times.
The treatise abounds in true and striking re-
fections, and exhibits the same power of subtle
analysis that marks the later works. But the
style is distinctly Ciceronian, and in its rounded
smoothness, so different from the abrupt in-
cisiveness of the 'Histories' and 'Annals,'
shows the influence of Quintilian, who was then
preaching a return from the style of Seneca to
that of Cicero. For this reason the great Justus
Lipsius, in 1574, attributed the 'Dialogus' to
Quintilian, and since then it has been ascribed
to Seneca, Pliny and others. But the weight of
evidence is decidedly in favor of the Tac-
tian authorship.
During the 15 years of the reign of Domi-
tian, years whose horror finds sombre expres-
sion in the opening chapter of the 'Agricola,'
Tacitus published nothing. But early in 96
there appeared, in rapid succession, the 'Agricola'
and the so-called 'Germania.' The for-
mer, the story of the life of his father-in-law,
whom he evidently loved and revered, is a
masterpiece of biographical writing. The style
is no longer Ciceronian but Sallustian, rapid,
terser and piquant, rising at the close to sus-
tained sublimity. The second monograph is
commonly known as the 'Germania,' but its
exact title is differently given in the important
manuscripts and cannot be determined with cer-
tainty. It falls into two parts. The 27
sections deal with the physical characteristics
of Germany and the institutions, beliefs and
customs of its inhabitants as a whole; the as-
suming 19 describe the individual peculiarities
of the separate tribes. The treatment is rhetor-
cal and ethical rather than simply scientific, so
that the purpose of the essay has often been
questioned and the credibility of its statements
attacked. But it is regarded as on the whole
a trustworthy account of German lands and
peoples, though the geography is weak and the
description of the tribes in the interior may
have been based upon insufficient evidence.
The Germans were then the object of much
interest (Trajan was in Cologne at the time of
his accession) and Tacitus, writing to satisfy
this curiosity, pointed out at the same time to
his countrymen, the contrast between their own
corrupt civilization and the vigorous sim-
plicity of these Northern tribes, and gave
a warning of possible danger.
In the introduction to the 'Agricola,' Tac-
tius announced his intention of composing
'memoriam servorum testimoniun honorum.' The first part of this
plan was realized in the years 104–10 by
the publication of the 'Histories,' consisting origi-
nally of 14 books, or possibly only of 12, cov-
ering the period from the death of Nero in 68
to that of Domitian in 96. But, instead of adding
the reigns of Nerva and Trajan, he then
wrote the 'Annals,' in 16, or possibly 18 books,
from the death of Augustus in 14 ('Ab excessu
Divi Augusti' is the actual title of the work)
and the point at which the 'Histories' begin. Of
this remarkable achievement, the continuous
history of the empire for 82 years, there is ex-
tant about one-half. Of the 'Annals,' we have
books I–IV with the beginning of V and the
greater part of VI, and, with a gap at the be-
ginning and also at the end, books XI–XVI,
that is, we have lost almost entirely the years
29–31 of the reign of Tiberius, the whole of the
reign of Caligula, the first six years of Claudius,
and the last two of Nero. The extant portion
of the 'Histories' ends in the middle of book
V and describes the eventful year 69 and part
of 70. The treatment is obviously much more
minute in the 'Histories' than in the 'Annals,'
and this is due to the fact that Tacitus is here
dealing with occurrences which cannot well
within his own lifetime. The loss of the reign
of Domitian is especially to be regretted.
Interesting as are the minor works, it is in
the 'Histories' and the 'Annals,' that the real
sensibleness and literary art of Tacitus are revealed.
His method is essentially scientific, though
he does not use archives and original sources
as much as would a modern historian. But he
strives conscientiously to ascertain the facts and
to determine the sequence of cause and effect.
A thorough aristocrat and lover of the old re-
public, he yet bows to the inevitability of the
empire and appreciates the enlightened rule of
a Trajan. But the reign of Domitian perma-
nently embittered his soul. He was gifted by
nature with a marvelous power to trace the
hidden springs of thought and action and ex-
perience of life bred distrust and made him an
expert in the analysis of human weakness and
guilt. His portrayal of Tiberius, for instance,
though certainly prejudiced and unjust, is
extraordinarily subtle and brilliant. The style,
which we may see in process of formation in
the 'Agricola' and 'Germania,' is characterized
by pregnant brevity, leading sometimes to ob-
security, by deliberate avoidance of balance in
the structure of the sentences and by poetical
phraseology. The influence of Virgil is marked.
See GERMANIA.

Bibliography.—The standard text is that of
Halm (Leipzig 1907). The 'Dialogus' has
been admirably edited by Peterson (Oxford
1893) and by Gudeman (Boston 1894); the
'Agricola' (Oxford, 1896), and also the 'Germania'
by Furneaux (1894); the 'Histories'
by Spooner (London 1891); the 'Annals'
There is a fine special lexicon by Gerber and Greef
(Leipzig 1903). There is an excellent translation
of all the works by Church and Brodribb
(London 1905); of the Annals' by J.
Emmsay (London 1904); of the 'Histories'
by Fyfe (Oxford 1915); of the 'Dialogus,' 'Agricola,'
and 'Germania' by Fyfe (Oxford 1908)
and by Peterson and Hutton (Loeb Classical
Series, New York 1914). Consult also Bois-
sier, 'Tacitus and Other Roman Studies' (New
York 1906).

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TACKLE, among seamen an arrangement of two or more blocks, with suitable ropes, for raising or lowering weights. The combination is usually designed to increase the capacity of the vessel's power. One block is fixed while the others are movable. Tackles are termed luff and watch, single and double Spanish burtons, Bell's purchase, luff upon luff, etc., according to the arrangement of the bearings, pulleys, etc. See BLOCK; PULLEY.

TACKS. See NAILS.

TACLOBAN, tâ-kô'ban, Philippines, pueblo, capital of Leyte Island; on the east coast at the southern entrance to the San Juanico Strait, on the northwest extremity of San Pedro Bay. It is the northern terminus of the east coast highway, has an excellent port, with large wharves. Pop. about 12,000.

TACNA, tâ-kâ'na, Chile, (1) a province occupying the northernmost extremity of the country, a large area, 8,686 square miles. The main ridge of the Andes runs just within the eastern boundary and a lower range runs along the coast. Pop. about 30,000. (2) its capital, a city of about 14,000 population, of local importance. The Chileans defeated the Peruvians in a battle here in 1880.

TACOMA, tâ-kô-ma, Wash., third city in Washington, seaport, county-seat of Pierce County, on Commencement Bay, 38 miles south of Seattle and 25 miles north of Olympia. Its phenomenal growth has given the city the name "The City of Destiny." It is also called the "City of Beautiful Homes" and the "City with a Snow-Capped Mountain in its Door-yard." It is situated at the head of navigation on Puget Sound and is the western terminus of the Northern Pacific and the Chicago, Milwaukee and St. Paul railroads, both of which maintain large ocean docks and car repair shops. Tacoma is also the American terminus for the Osaka Shosen Kaisha, a Japanese steamship line with headquarters at Osaka. Tacoma's harbor is one of the greatest deep sea harbors in the world and because of its similarity to the Italian city, Tacoma is often referred to as the "Naples of America." 

Topography.—The Puyallup River empties into Commencement Bay within the city limits and is one of five waterways that help make up this modern port. The city is built on rising ground which reaches an altitude of 418 feet above the river. The best residence portion of the city is on a plateau, elevated about 200 feet above the blue waters of the Beautiful harbor, and from any portion of this section may be seen stretches of gleaming water losing themselves among the wooded islands; beaches, white, gray and brown, and towering headlands. The Olympic Mountains stretch along to the west, rugged, snow-capped peaks, and from near the city rises Mount Rainier, here known as Mount Tacoma. The Mountain that was God, as one author calls it, an attempt to peak, is 14,520 feet high. It is but "four hours from Tacoma to the Glaciers," from tidewater to mountain elevation. The streets of Tacoma are level and paved, and so generously and wisely is the city laid out that it has not a street less than 60 feet wide, while it has several noble avenues 100 feet wide and a few 120 feet. Neat homes—of banker, merchant, manufacturer, wage-earner—is surrounded by beautiful and pretty gardens. The climate is without its equability and mildness, the temperature being 30.6°; the highest, 98°; and the mean minimum, 39°; is 43 inches, with little or no snow.

Trade and Commerce.—Because of its strategic position, Tacoma has always had a huge water-borne commerce. In 1918, 1,666 arrivals from foreign ports were recorded, with cargoes of 2,103,656 net tons, clearances for foreign ports numbers with a tonnage of 2,103,595. The total imports and exports was $318,613,508, exports alone totaled 2,160,474 barrels, at $22,747,555. The daily capacity of the mills is 9,000 barrels. Tacoma's warehouses have a storage capacity of 75,000 bushels. From the time in 1869 schooner-load of lumber from the old mill was shipped to San Francisco, it has been the leading lumber market city of the Pacific Coast. There are 100 mills in the district in addition to the mills of Chicleaus & Co. In 1918 the exports totaled 93,500,000 feet. Tidal steamship lines operating to and from Japan and the Pacific Steamship Company have millions in construction and improving present port. The Hub for the southwestern coast and Washington, Tacoma possesses a huge sale and jobbing trade. Her jobbing in 1918 totaled $160,000,000; retail trade $500,000,000.

Manufactures.—With 1,850 business enterprises, including over 300 manufactory plants, Tacoma has approximately 50,000 wage-earners, with a monthly pay-roll amounting to $6,763,000. The total investment in 1918 was $152,000,000, the amount $27,900,000 represents the wages paid to 8,000 men, and is one of the largest laid out steel shipyards in the country. The Tacoma Smelter employing 1,000, an output of 150,000,000 pounds of copper at $45,000,000 in 1918. This were were average prices of Federal and state products, marble, iron, and other products, including machinery, boiler and marine engines.

Most of Tacoma's industries are on 1,500 acres of tidelands extending further the southern boundary of the harbor.
interlaced with railroad tracks and road-

TACOMA.

banks.—Tacoma has six na-
ed State banks. At one time there were

1.000,000 hydro-electric power

2,000 horse-power capacity; a $2,300-

ility water system with a 42,000,000

tally capacity; a municipal freight and

dock, and a municipal street car line

 industrially the industrial district.

length of paved streets is 110 miles;

eters, 307 miles; cement sidewalks;

sanitary sewers, 224 miles; storm

iles. Assessed valuation (50 per

true valuation) is $9,508,011.

the indebtedness, $3,594,000.

City power 15 of a cent two cents per kilowatt,

g load factor, cheapest rate in the

private power companies have plants

capacity of 72,000 horse power, with

identical rates. The streets of the

electrically lighted. A single gas plant

Tacoma consumers; also those in the

Olympia. The parks and playgrounds

met by the metropolitan park

members of which are elected by popu-

The acreage of parks is 1,200, includ-

Defiance Park and Zoo, 662 acres,

ight Park, 40 acres. In addition are

as outside of the city limits surrounding

way Lake, Stellacouy Lake, Ameri-

Gravelly Lake. There are four

with 18-hole courses.

Buildings and Clubs.— Most promi-

public buildings are Federal building

States Post Office, custom office, internal

and federal court), Pierce County

House, City Hall, Tacoma building

by Tacoma Commercial Club and

Commerce and Weyerhaeuser

Company), National Realty building;

Fidelity building, 12 stories; Tacoma

Jones Block (Pantages Theatre),

L. Davis building, Perkins building,

dume building, Tacoma Hotel, Olympia

northern Pacific Headquarters building,

building, Provident building, National

Tacoma building, Bank of California

Scandinavian-American Bank building,

Prominent clubs include Elks,

ub, University Club, Moose, Rotary

and the downtown buildings; Automobile Club, Y. M. C. A.,

A. Commercial Club and Chamber

ere, Tacoma Country and Golf Club,

Country Club, Lochburn Golf Club,

Pond Golf Club, Tacoma Yacht

Club, Tacoma Tennis Club, Soldiers and

Sailors Club.

Transportation.— Six railroads have ter-

or connections in the city. The Northern

Pacific and Chicago, Milwaukee and Saint

railways have their western terminals in

Tacoma, including car repair shops, and

ocks. The Great Northern and the Oregon

and Washington (Union Pacific) railroads

operate in the city, and the Great Northern has

connections with the Canadian Pacific and

Chicago Great Western railroads. Electric

interurban trains operate between Tacoma and

Seattle on a half-hour schedule; also between

Tacoma and Puyallup. There is a total of 143

miles of track operated by the local traction

company. Automobile stages on regular

schedules operate on a dozen paved highways

every city and town in Pierce County and

adjacent counties, including the cities of

Seattle, Olympia, Aberdeen and Hoquiam,

and Chehalis and Centralia. Local steamers

serve all points on Puget Sound, popularly

Victoria and Vancouver, British Columbia, and

to Pacific Coast and Alaskan ports.

Camp Lewis and Rainier National Park.—

The largest permanent army mobilization and

training cantonment in the United States is

Camp Lewis, just south of Tacoma's city

limits. The cantonment contains 76,000 acres

and is 18 miles long and 12 miles wide.

Citizens of Tacoma and Pierce County (the city

pays 80 per cent of the taxes) voted $2,000,000

in bonds to purchase the ground for the

government for military purposes. In

sequence, a full division of troops will be

maintained at the camp permanently. Paved

highways with auto transportation lead from

the city to the camp. There is also steam and

electric railway transportation.

From Tacoma automobiles convey a tourist

in four hours over one of the finest paved

highways in America to the Glaciers of

Rainier National Park and to matchless Mount

Rainier (or Tacoma, its local name), 14,520

feet high. The park is the most popular of

those supervised by the United States govern-

ment. Attendance in 1918 was 50,000, exceed-

ing that of any other national park. There is

transportation to the park over the Tacoma

Eastern to Ashford from Tacoma, giving rail

transportation to within a few miles of the

park entrance.

Education.— Tacoma is the seat of the

College of Puget Sound (Methodist), Pacific

Lutheran Academy (Lutheran), Annie Wright

Seminary (Episcopal), Academy of the Visita-

tion and Aquinas Academy (Roman Catholic).

There are eight parochial schools, six com-

mercial or business schools, and in the public

school system two magnificent high schools

and 32 grammar schools. The total enrolment

of the public schools is 18,904, including 2,000

attending night schools. There are 645 teachers

employed. The Stadium High School has a

Greek amphitheatre called Stadium which has

a normal capacity of 32,500 persons, which can

be increased to between 40,000 and 50,000.

The Carnegie Library, with two branch libraries

and branches in the high schools and grammar

schools, has 85,598 volumes with a net

circulation in 1918 of 338,237. The total value of

library property is $200,000, and the number of
registered borrowers 18,111. Overlooking the Stadium and opposite the high school are the Ferry Museum, with a large collection of Indian curios. On the use of the old home of the Washington State Historical Society.

Churches and Charities.—Nearly every religious sect or denomination has a house of worship in Tacoma, the city being particularly well equipped with beautiful churches, the total number reaching 135, the principal denominations being Methodist Episcopal, Presbyterian, Lutheran, Episcopal, Congregational, Roman Catholic, Baptist, Christian Science, Christian, Jewish, Evangelical, Friends, Adventists, United Presbyterian and Universalist; also Salvation Army and Volunteers of America.

Charitable institutions include the Northern Pacific Hospital, County Hospital, Tacoma General Hospital, Saint Joseph's Hospital, City Contagious Hospital, Western Washington Hospital for the Insane at Fort Stillicom, a suburb; the Children's Home, City Rescue Home, Parkland Children's Home.

History.—Tacoma city was originally within the boundaries of the first ward, popularly known as Old Town, now called Old Tacoma. The city was laid out in 1868 by Gen. M. M. McCarver. In July 1873 the Northern Pacific Railroad established its Pacific Coast terminus on Commencement Bay, giving it the name New Tacoma. The city was also called Commencement City. In 1880 the new town became the seat of Pierce County, and in 1883 Old Tacoma and New Tacoma were consolidated and incorporated as a city. Since that time additional territory has been annexed on four different occasions, giving the city a total of five taxing districts. The present area of the city is 25,168 acres of land and 2,752 acres of water, or 39,81 square miles. The distance from northern to southern boundary is seven miles. The 35 wharves and docks have a lineal front of one and a half miles.

Population.—Government census (1880) 720; (1885) 1,100; (1890) 36,006; (1900) 37,714; (1910) 83,743; (1 Jan. 1919, local estimate) 142,447.

EDWARD P. KEMMER, Managing Secretary of the Tacoma Commercial Club and Chamber of Commerce.

TACONIC (ta-kön'ik) MOUNTAINS, a range extending nearly north and south, uniting the Green Mountains of western Massachusetts with the Highlands of the Hudson. The highest peaks are Equinox in Vermont, 3,847 feet, and Greylock in Massachusetts, 3,305 feet. The Taconic system, in geology, was named from the characteristic strata of this range, a metamorphic rock, believed to be older than the Silurian system.

TACONIC SYSTEM, a term applied by Prof. Ebenezer Emmons, in 1842, to certain azoic and paleozoic rocks occurring in the eastern part of New York and western parts of Vermont and Massachusetts. These he believed to be the equivalents of the Cambrian rocks of England. Subsequent investigations have shown that Emmons misread the geological structure of the regions studied by him, and his arrangement of the strata has, therefore, been set aside. The subject has given rise to much discussion among American geologists.

The Taconic System is nowhere reached in the Taconic Mountains, but it is described and illustrated in 'The Geology of the Taconic System of Emmons,' by Professor LeRoy Pelley, and in 'Some Observations on the Taconic System of Emmons,' by Professor LeRoy Pelley, and in 'Some Observations on the Taconic System of Emmons,' by Professor LeRoy Pelley, and in 'Some Observations on the Taconic System of Emmons,' by Professor LeRoy Pelley, and in 'Some Observations on the Taconic System of Emmons,' by Professor LeRoy Pelley, and in 'Some Observations on the Taconic System of Emmons,' by Professor LeRoy Pelley.}

**TACTICS.** Tactics has regard to the actions of an army in the actual presence of an enemy, and may be defined as the strategy on the battlefield or the science of maneuver and combining those military units which discipline and the regimental system brought to the perfection of machines. It is admirably described by Napoleon as the 'stronger'—that is, of bringing overwhelming force to bear on any given whatever may be the relative strength of entire armies opposed. The earliest recorded use of the word in antiquity was in the phrase 'the stronger overcomes the lighter.' The growth of democracy arose the organization of the phalanx, the adherents of which were irresistible; and its firmness equally charged in front. It, however, changed with great difficulty; was much deranged in the war against the French; and was finally abandoned in a suit, or if attacked in flank. Far lighter and more mobile was the Roman legion. Among Roman tactics was also the admirable intrenchment which they scarcely ever omitted as a natural source of strength for their position.

Events reproduce themselves in cycles, with decay of Roman civilization came the mail-clad heroes and cavaliers—men this time on horses—who monopolize the ords of battle, while the undisciplined foe had an undue share of the dangers. Later, in the feudal period, this disparity between foot and foot was diminished by the employment of bodies of archers, whose shafts riddled distant death. The adoption of gunpowder for small arms altogether neutralized the superiority of the armored knight. This, c Forgna brought infantry into the front line in mass, and threw cavalry into the status of an auxiliary. The French Revolutionary Wars brought to the development of artillery as a weapon and Napoleon employed this to its fullest extent, a practice followed by the best modern generals, who never a man where a cannon ball can do the greatest damage. Frederick the Great was considered an excellent tactician for fighting with infantry, and he employed the French system of tactics to a great extent. Before the battle of Waterloo, the British leaders had acquired sufficient confidence in their troops to use them in a double line.

In the battles of Gravelotte and Sedan the turning movements were complete losses of the tenth German division at Vaux prove what a serious matter it is to make direct attack against the breach-loading battery, amounts to about 4,000 men. It is necessary to make vigorous attacks on points of the French position, so as to
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continued this march until the fire caused a break in their lines and a retreat, or until they reached the work after enormous losses and held it as the result of a hand-to-hand fight. The skirmish line was so small in comparison with the main force that it really amounted to nothing and the attack was in fact made in solid line. The attack and the forward movement were not distinguished. This defensive formation was the principal cause of the heavy losses.

In offensive tactics we may consider three general modes of attack, one of which the commander of a combined force must select as the most suitable for his purpose: (1) Frontal attack, which would mean a direct advance upon the whole of the enemy's line or position. As a general rule, this form of attack is unadvisable, as even in case of success the result is not decisive; the enemy's line of retreat being unassailed, he simply falls back to a position more to the rear. There may, however, be situations when the nature of the ground prevents any other mode of operation, or where the frontal attack may be made use of to feel the enemy and to determine his exact dispositions, in preparation for a concentrated attack upon one of his weak points, as soon as they are discovered. (2) Combined attack upon front and flank. In this case the enemy is attacked in front at the very time that a portion of the force is directed at one of the flanks. An attack upon the flanks by itself unaccompanied by a frontal attack is not advisable, except in the case of small detachments acting against one flank; unless the attack can be effected by surprise, in which case the enemy is unable to meet it in time by a change of front. Were a strong force in position attacked solely on the flank it would quickly form up its reserves to a new front, the troops of the original front coming up in support. For a flank attack, therefore, to succeed, it must, as a general rule, be accompanied by a frontal attack, sufficient to hold the enemy to his original position. An attack upon both flanks combined with a frontal attack can only be tried under circumstances of great superiority of numbers, without which it would become a most dangerous operation, enabling the enemy to give the counter-stroke of a weak point of a straggling line and beat the assailants in detail by cutting their force into two. In engagements where the numbers are small the flank attack may be made alone. (3) Concentrated attack upon a weak point, to break through the enemy's line or force his position. This mode of attack, if the most difficult of execution, is undoubtedly in case of success the most decisive, the enemy being broken into fractions which can subsequently be beaten in detail. The enemy's line of retreat may also thus be arrived at, and his communications cut before he can recover himself. The attack must always be made with force sufficient to resist a counter enveloping attack on the part of the enemy; which might otherwise be disastrous in its results. The increased range of modern guns and rifles has made this attack more hazardous than ever, for a concentrated fire-action can now be brought to bear on the assailant, not only from all parts of the defense in his immediate front, but in most cases from either flank as well.
Unless, therefore, the ground covers the movement in a great degree it should not be attempted.

In addition to the above primary modes of attack, a movement may also be considered. This might be looked upon as almost a form of flank attack were it not that it differs from it in some essential particulars. The turning movement is more often a menace than an attack for it threatens the enemy's line of retreat so as to force him to change front or shift his position before he enters the combat. The manœuvre differs also from a flank attack inasmuch as it removes the scene of combat from the position held by the enemy, while the flank attack takes place on one of the flanks of the position itself. The turning movement may be made, either with a portion of the force at command, or with its whole strength. In the first case, the conditions should render it improbable if not impossible that the enemy could act offensively in turn upon each fraction of the divided force. Otherwise the separate movement should not be attempted, as it must end in disaster. When the ground permits, or is favorable, cavalry and horse-artillery should be especially utilized to the turning movement. They should, therefore, nearly always form a portion and sometimes the whole of the troops employed in the service, both because they can by rapid advance produce the moral effect of surprise, and because they can more easily avoid destruction by a superior force.

The commander of a small force of the three arms should have no difficulty in preparing his plan of attack and issuing his orders, upon receiving reports of the strength and dispositions of the enemy and of the nature of the ground upon which he must act. In ordinary cases when small forces are engaged, the cavalry, which reconnoiters in advance, will bring in sufficient information for the purpose; but if the enemy should be covered by advanced troops, it may be necessary to make a special reconnaissance, sometimes supported by guns, in order to arrive at a knowledge of his strength and intentions. With large forces this work must probably be carried out by the advanced guard the artillery of which, reinforced where necessary from the main body, would take up what may be called a preliminary artillery position and open fire at long range to cover the advance of the troops employed in the reconnaissance. The information required being obtained, the commander would issue his orders. In the case of very small operations or of a sudden encounter with the enemy these would be given verbally; under other conditions orders should, if possible, be written. Should these orders consist of detachments under various commanders, it would be necessary that there should be a general order for all, and also a special order addressed to each commander where separate action is required. The general order should be clear, precise and complete, and as short as quick compliance with these requirements will permit. It should contain:

1. The conditions or circumstances of the intended action with what is known of the enemy so as to guide the commander in determining the mode of action and the order in which the detachments should be sent in order to coordinate their efforts.

2. The mode of action determined upon, and how to be undertaken; thus for instance, to attack the enemy when he is touched on in direct advance, or, to attack the whole, or a certain part of a position.

3. The strength, composition and general division of the attacking force, with names of commanders; this may be given more in detail in the margin of the order if thought necessary.

4. The preliminary positions to be taken up by each distinct part of the force with their directions of attack.

5. The hours at which these positions are to be assumed, and at which the forward movement or attack is to be commenced.

6. The position where the commander of the troops will be found during the action, to which all references or reports are to be made or sent.

These clauses would be sufficient for a small force, but in operations of greater magnitude it would be necessary to add:

7. The positions of the ambulance and field hospitals, and the order of march of the trains of the various columns.

It must be understood that the dispositions of the troops thus indicated are only intended for the first phases of the engagement, for, until the enemy's counter-plans are developed, the final movements which depend thereon cannot be defined. The special orders addressed to separate commanders should contain nothing that may tie their hands too much in matters of detail. As a rule, they should be told the thing to do, not the manner of doing it, and within safe limits, to be named, they should be allowed free action.

For the purpose of watching the phases of the combat, the position which the commander should assume during the engagement ought, if possible, be on an eminence, from which he can perceive the principal portion of the ground over which the troops are to work. He should not quit this post (duly announced in the "order") without exceptionally good reasons, and if he is obliged to do so, an officer should be left behind to direct all reports or messengers to the new station of the commander.

The orders which are necessarily transmitted during an action by the commander of the troops are of much importance and should be given with great care. They should, if possible, be in general harmony with the original plan of attack, although certain modifications may become necessary. They should be concise but detailed which are better left to commanders of corps, nor should the commander of the troops interfere in the execution of his orders, further than to assure himself that they are carried out. He should be satisfied on this point by means of constant reports and communications which must be kept up without interruption during the action between him and the commanders of separate corps and detachments. When the reports cannot be sent by an officer of the commander of the troops, the reports of the latter in the exact hour and minute of dispatch. Above all other matters it is most important that the commander of the troops should be immediately informed when circumstances render it impossible for a subordinate commander to carry out the orders or instructions, as the failure
TACTICS

As the rule to be followed is, that it shall fire on that arm of the enemy which is for the time the most important, the enemy's infantry will in all probability be now the object. In either case, a moment may arrive during this stage when a second position more in advance is necessary for the guns, on account of their fire becoming masked by their own advancing infantry. If a portion or the whole of the guns can, in such case, be advanced rapidly and placed in a good position (especially on a flank, whence they can add their own fire to that of the advancing troops, which are at the moment absorbing the whole attention of the defending infantry), the proximity to the enemy's line, of this second principal artillery position, must not be too much limited by ordinary rules of caution. When the attack and defense are nearly matched, it is clear that the addition of a close artillery fire on either side may turn the scale and compensate by decisive success for any loss sustained. As this close action of guns may in case of repulse lead to confusion, it would perhaps be advisable that the whole of the available artillery should not take up this second advanced position, but that a portion be held in reserve, massed in a favorable position, and be kept in action all the time in support of the advanced battery.

If the attack is successful and the enemy retires either before the demoralizing influence of the last steady advance, or broken by actual assault, the position he occupied is quickly assumed by the artillery and a heavy fire brought to bear on the retreating troops. The reserve cavalry, which by this time has been brought up from the rear, and probably posted on the weaker flank is now launched in pursuit accompanied by horse-artillery, the superior mobility of both rendering their use peculiarly well suited to this service. The commander of the troops would move forward from his starting point, and take his develop fire-action should rapidly increase as the point of attack, for upon its weight depends its success.

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But cavalry at this stage can only minor part, unless the ground be more usually favorable to its action; with the on, therefore, of strong supports to the acting on the flanks, the remainder of would still be kept in reserve, but far to the rear that it could not be up quickly if required to make a demonstration on either flank artillery, which during the former has been of first importance on account of its long range, now falls into the sec. The circumstances of the case must be whether it shall fire on the enemy's troops, or whether it shall fire on the enemy's troops. As the rule to be followed is, that it shall fire on that arm of the enemy which is for the time the most important, the enemy's infantry will in all probability be now the object. In either case, a moment may arrive during this stage when a second position more in advance is necessary for the guns, on account of their fire becoming masked by their own advancing infantry. If a portion or the whole of the guns can, in such case, be advanced rapidly and placed in a good position (especially on a flank, whence they can add their own fire to that of the advancing troops, which are at the moment absorbing the whole attention of the defending infantry), the proximity to the enemy's line, of this second principal artillery position, must not be too much limited by ordinary rules of caution. When the attack and defense are nearly matched, it is clear that the addition of a close artillery fire on either side may turn the scale and compensate by decisive success for any loss sustained. As this close action of guns may in case of repulse lead to confusion, it would perhaps be advisable that the whole of the available artillery should not take up this second advanced position, but that a portion be held in reserve, massed in a favorable position, and be kept in action all the time in support of the advanced battery.

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arms decide to stand on the defensive, he should take up the position most suitable for his purpose without delay, as the superiority to be attained by this course of action must result in great measure from the advantages attendant upon choice of ground. A good position should be such, from a tactical point of view, that the different arms could be disposed for defense in the manner most suitable to their action and that there should be facilities for concealing their strength, composition and posts from the view of the enemy, and of preserving them more or less from his direct fire during the attack. It is also of the highest importance that the front of any position selected for defense should be clear for view and fire, as should also be the flanks, unless they rest on impassable obstacles.

The first stage of the defense which was commenced with the reconnaissance of the enemy would thus comprise the selection and occupation of the position by the defenders, as well as the advanced action, if any, of the artillery, already alluded to. Upon the selection of the ground most suitable for the artillery of the main position, will in great measure depend the exact trace of the fighting line for the infantry, the positions for the guns so much depending upon the circumstances of each case, and more especially upon the configuration of the ground. The guns of the position should, however, be placed so as to bring the enemy's columns under fire at long range, and hence they ought to command every distant approach. They should also be able to pour a concentrated fire upon the probable positions which will be assumed by the attacking artillery, and be stationed so as to sweep the ground in front of the position from the earliest to the latest moment of attack. The defense of the flanks in the case of large forces must be specially provided for.

It would, therefore, appear that, unless the ground is peculiarly favorable for posting guns in flanking positions, where without being exposed to enfilade they can bring a cross fire to bear upon the main attack, and a flanking one to protect the immediate front, the required command can only be obtained by the guns being placed in the front line and preferably at the salients, should an irregular contour mark the front of the position. The general distribution of the infantry would probably be in three lines; the first or fighting line of defense, the special supports, and the reserves. If time for hasty fortification is permitted some sort of entrenchment should be always prepared for the batteries, as even a low parapet of earth gives protection to the gunners. Great care should, however, be taken that the newly broken earth is concealed or covered in such a manner from the enemy's view, that it shall not serve as a mark for their artillery more distinct than would otherwise be presented by their guns alone. Shelter-trenches may also be prepared for the infantry in the fighting and supporting lines. Neither the places prepared for the batteries nor the shelter-trenches should be occupied by the guns or troops till the proper moment for action arrives.

Advanced skirmishers or marksmen, and with this view, the batteries ought to be covered in their immediate front by a line of extended skirmishers, placed either in trenches or pits or behind natural cover, and from four to five hundred yards in advance of the guns which they defend. If the battery is on a flank, this protection should also be extended for a similar distance to the flank. The infantry thus posted would remain as long as possible in position, and only retire when, at the final stage, they are driven back by the overwhelming advance of the assailants. Besides their principal function, of keep-off the enemy's skirmishers from too early approaching, the batteries of the defense, these advanced infantry could often bring an irritating fire to bear upon the attacking artillery at its first principal position, and perhaps serve to prevent the guns from approaching to the most telling range. This possible action would of course depend much upon the features of the ground.

It is impossible to lay down any rule for the exact position of the artillery of reserve. High ground near the exposed flank, provided facility of movement therefrom in case of necessity is present, and if the features would often be suitable. The guns should, however, in any case be well up to the front, so as to lose no advantage of range from the commencement of their fire. A position in rear which entails would not be comparatively useless during the later stages of the defense, when once the attacking infantry has advanced so close that the fire of the retired batteries would be masked by the ground, or by the defending infantry lining the position. Guns so placed might be useful in defending an inner line, or for supporting a counter-stroke delivered inside the position after the assault has been made, their action would be lost almost altogether during the period immediately preceding the final assault if not by the position itself or by knowledge of ranges and distances, possible to the artillery of the defense, presents a great advantage; but if circumstances have not permitted the gunners to ascertain them during the preliminary arrangements, by aid of rangefinders, aeroplanes, or other means, the earliest portion of the artillery action must be utilized to obtain correct estimates of the ranges to all important points, by means of trial shots.

There are certain points or portions of all positions, the possession of which would assure the assailant the greatest tactical advantages. In many cases also the configuration of the ground appears to limit the movements of an enemy to certain lines of operation. The defense should, therefore, occupy these parts of the position, not by force, but by assumed or apparent force by the enemy, while preserving the general line. Under the second condition the force should be prepared to resist advance by rapid reinforcement at any of the possible points of approaches. The force in the third line should be placed so as to be available for strengthening the most likely points of attack and to be advanced skirmishers or marksmen; and with
TACTICS - TADOUSAC

protect the line of retreat. Most of the and some horse-artillery if it can be used will fulfill the reserve. It is very well placed for opening fire, and the reserve is in position if needed for the reconnaissances. A portion of this force is placed on the right for the purpose of joining in and ranging movements and flank attacks upon the left, and of covering the retreat of the engaged in these counter-attacks if unf avorably. The second stage generally commences with opening fire at long range from the batteries of the system, upon the heads of the enemy's infantry to give it order of...and deploy the artillery. The attacking artillery will reply now from its principal position as the artillery of the attack is at the most important arm it must be used by the guns of the defense. In artillery duel the defenders should have ample time, as knowing accurately the ranges of various points which must be occupied by the enemy in his advance, and as being more entrenched while the assailants are all at the mercy of the firing of the artillery of the defense are brought to the position and open long-range fire upon the enemy with more or less effect. The third stage the advance to effective range of the attacking infantry has forced...the direction in which it is object of the defending commander over, by every means in his power. As ports and reserves of the assaulting...farmers, the concentrated fire of part of the defense. The fourth stage the real point menaced attack being made clearly apparent, the...in the enemy, now has become the principal arm in the attack. Should a counter-attack be probable, it takes place during this stage, unless it is delayed until after the assault. The...to a flank movement of the attacking force would also now have to be made. It is of a counter-stroke being delivered defense, part of the cavalry and heavy...finally, it should generally move forward flanks at this part of the action to seek opportunities of throwing the flanks of attacking infantry into disorder, or of taking too rashly advanced. The fifth or last stage comprises the final of the attack upon the position or the forces' enforced retreat therefrom. In case pursuit by the victors may ensue, lately and during the final assault, every gun of the defense will concentrate its fire upon the attacking forces, in order to check their advance, and the assailants retire, the guns must continue to fire until the assaulting troops are sent forward in pursuit. Should...on the other hand, be forced to attack, guns must cover the movement and the infantry to disengage itself. The underlying idea of all infantry tactics must be to bring into action with all the units well in hand. The ideal of the men would be those making possible a quiet, quick and orderly advance without halting to open fire, but this is impossible with the highly developed weapons of today. However, though some of the attacking infantry managed to close with the enemy, there would be too few left for a bayonet attack. Therefore, in order to make a successful assault, the infantry must move up under covering fire. To provide cover for this protection, it has equipped itself with the pistol, bayonet, fire, the one-pounder, trench mortars, the effective hand and rifle grenades, and has called to its assistance its supporting arm—the artillery. The enemy, attempting to protect himself from the terrific fire, he knows will precede the infantry attack, has prepared deep dugouts and bombproofs, in which he often hides until the last possible minute.

Despite the fact that all of the above preparations are simply to give the bayonet man a chance to use his weapon (and to kill as many of the enemy as possible while doing it), it follows that fierce action is more important than shock action, for without the fire the shock would be impossible. Therefore, the bayonet men must know how to shoot their rifles and to co-operate with the machine gun, the grenade, and the artillery, and must be so formed that during the assault they can deliver effective rifle fire, present a solid front to the enemy in the bayonet charge, and be close enough to furnish mutual moral and physical support. The wave attack that has been used so much in France was produced in order to furnish the greatest amount of mutual support among automatic riflemen, grenadiers, the one-pounders and riflemen, and at the same time to allow the greatest number of riflemen (bayonet men) to close with the enemy in the best formation possible. All of the conditions so far discussed make it imperative that the assaulting troops be perfectly organized and that they follow their covering fire (barrage) as closely as possible.

EDWARD S. FABOW, Consulting Military and Civil Engineer.

TACTICS, Naval. See NAVAL TACTICS.

TACUBAYA, tā-koo-bā'yā, Mexico, a city in the federal district, situated three miles southwest of Mexico City, is a principal pleasure resort of the valley of Mexico, and has many fine buildings and gardens. The national observatory is situated here, as well as the castle of Chapultepec. Pop. about 40,000.

TACULLI, an American Indian tribe of the Athapaskan family, residing in British Columbia, at the headwaters of the Peace and Fraser rivers. They numbered about 750 in 1918 and lived on various small reservations. The majority of them are Roman Catholics, having been converted by French missionaries.

TADEMA, tā'dē-ma, Laurence Alma. See ALMA-TADEMA, LAURENCE.

TADOUSAC, tā-doo-zik', Canada, a town in Chieoutimi and Saguenay County, Quebec, situated at the confluence of the Chicoutimi River with the Saint Lawrence. It is a summer resort; and noted as being the oldest settlement in Canada. It was one of the early centres of the fur trade, and the home for a time of Father Marquette, who developed the weapons of to-day, and was visible one of the early Jesuit establishments. Pop. 2,500.
TAPOLES—TAFT

TAPOLES. See Fogo.

TAFILET, tā-fē-lēt', or TAFILELT, Morocco, an oasis on the southern border of Morocco and northwestern border of the Sahara region, 200 miles south by east of Fez. It covers about 530 square miles, and has a population of about 5,000, distributed among about 150 villages, of which Aumam is the most important. The date-palm is cultivated, and silks and rugs are manufactured.

TAFT, Alphonso, American jurist: b. Townsendh, Vt., 5 Nov. 1810; d. San Diego, Cal., 21 May, 1892. He was appointed judge of the Superior Court of Connecticut, serving until 1872, when he resigned to resume his law practice. On 8 March 1876 he was appointed by the war to the post of Attorney-General. During 1877–82 he was engaged in practice in Cincinnati, and in April of the latter year was sent as Envoy Extraordinary and Minister Plenipotentiary to Austria. From 1884 to August 1885 he was Minister to Russia.

TAFT, Charles Phelps, American lawyer and statesman; half-brother of President Taft: b. Cincinnati, Ohio, 21 Dec. 1843. He was graduated at Yale University in 1864, and later studied at the universities of Heidelberg, Berlin and Paris. He was admitted to the bar of Ohio in 1866 and in 1869–70 was engaged in practice in Cincinnati. In 1879 he became the principal owner of the Cincinnati Times which in 1880 he consolidated with the Star as the Times-Star, of which he has since been editor. He was a member of the Ohio House of Representatives in 1873 and served in Congress in 1895–97. He was presidential elector-at-large from Ohio in 1904, and president of the Ohio electoral college in January 1905.

TAFT, Henry Walters, American lawyer, brother of President Taft: b. Cincinnati, Ohio, 27 Jan., 1846. He was admitted to the bar in 1868 and later studied at the Cincinnati and the Columbia Law Schools. He was admitted to the bar in 1882 and engaged in practice in New York, where he is a member of the firm Cadwalader, Wickersham and Taft. He was special assistant to the Attorney-General of the United States in the tobacco trust investigation. He was a member of the New York board of education in 1896–1900; a trustee of the College of the City of New York in 1903–05; and since 1908 has been a trustee of the New York Public Library. In 1907 he was appointed chairman of the Permanent Legal Advisory Board for Greater New York under the selective service regulations.

TAFT, Lorado, American sculptor: b. Elmore, Ill., 22 Dec. 1871; and studied at the University of Illinois (1892–93), later at the University of Illinois (1897–98). He opened a studio in Chicago in January 1896; from 1896–1907 was instructor and since lecturer at the Art Institute of Chicago. He has since lectured at the University of Illinois (1892–1902) and since 1902 has been professor of the history of art. He won the medal at the Columbian Exposition (1893); silver medal, Pan-American Exposition, Buffalo (1901); gold medal, Pan-American Exposition (1904). His lectures exercised a wide influence: he received the honorary L.H.D. from Northwestern University; of 'The History of American Sculpture,' from the Board of Education; of 'The Eternal Silence,' from the University of Chicago; of 'Solitude of the Soul,' from the University of Michigan; of 'Blackhawk,' from the University of Nebraska; of 'Washington,' from the University of Washington; of 'The Great Lakes,' from the University of Ohio; of 'Soldiers' Monument, Indianapolis;' from the University of Indiana; of 'Ogle County Soldiers' Monument,' from the University of Illinois; of 'The Chicago Memorial Fountain, Denver; Cole' from the University of Pennsylvania. He has since lectured in several universities.

TAFT, William Howard, 27th Pres. of the United States: b. Mount Pleasant, Cincinnati, Ohio, 15 Sept. 1857, son of Judge and Louisa M. (Torrey) Taft; graduated with honors from Yale; studied law in Cincinnati, Ohio, and for a time Collector of internal revenue at Cincinnati. He was a native of Cincinnati, and after 1885 being county solicitor, in 1886 he married Helen Herron. In 1887 Governor McKinley appointed him to fill an unexpired term of the Superior Court. He was later Solicitor General of the United States, and in 1892 he was appointed solicitor-general of the United States. In 1892 he was made judge of the Sixth Circuit, a position for which he was fitted, and the work of which he was congenial.

On 12 March 1900 President McKinley asked him to head a commission to establish government in the Philippines, and on 1901 he became first civil governor. He copied both appointments at the expense of his personal preference for a career in politics, being influenced by a deep sense of responsibility toward a genuine affection for Filipinos. In 1902 Roosevelt twice an appointment to the Supreme Bench of the United States, but his rank and degree in his chief personal ambition, his immediate duty was to continue in the Philippines. As an executive his work was highly successful. In 1902 he conducted at Rome the negotiations for the purchase of the Friars' lands, but his rank and degree in his chief personal ambition, his immediate duty was to continue in the Philippines. As an executive his work was highly successful. In 1902 he conducted at Rome the negotiations for the purchase of the Friars' lands, but his rank and degree in his chief personal ambition, his immediate duty was to continue in the Philippines. As an executive his work was highly successful.
before they would be ready for self-government. He believed in "The for the Filipinos," and opposed extension in the interest of American urged tariff concessions for Filipinos.

In 1904 he became Roosevelt's Sec-

Vice-President, and for over four years was successively in the United States, and in the Panama Canal. In 1906, when called for American intervention, he went to Cuba, and for a time acted as governor. In 1907 he visited Cuba, and later Japan and China, going to the Philippines for the opening of the legis-

bly, and returning by way of Russia on 06–13 he acted as president of the American Red Cross.

Roosevelt was exerting his influence the Republican nomination for his own War, whom as post-

standard of absolutely unflinching service in every point of public duty, and a lacking courage and willingness toubs;

2. The President declaring that Taft

ian who I feel is in an especial senseOmtative of all that in which I most political life."

3. With this recommenda-

l on the strength of his ideal train-

ance. Taft was given 321 electoral ryan's 162.

sident lacked the magnetism and orce of his predecessor. In general moderate position on public questions. e-of-the-road people," he said (1911), not extremists are, we believe, the essives, because you do not make y great strides; you make progress p."

His position on important issues summarized as follows: (1) In con-

the Post-Aldrich Tariff Bill. The influence in favor of downward revi-

protective basis, just sufficient to difference in cost of production be-

and abroad. Though not satisfied provisions, he signed and defended ever passed. He favored vision on the basis of reports to be a tariff commission; and he vetoed ones of several schedules largely be-

were not based on such reports.

1 for reciprocity with Canada. (2) vation his fundamental views were erent from those of the Progressives med to believe. He hesitated, how-

reached the executive power, and Con-

solidated it; gave him the power he re-

Unfortunately his support of Secre-

inger against Roosevelt's friend, appeared to place him in opposition to s of his predecessor. (3) In the

broad and trust regulation he dict enforcement of existing law and stration secured the dissolution of ard Oil and Tobacco trusts. He clarification of the Sherman law and dustry that was doing business. (4) He was opposed to radical schemes of direct popular

government, in particular the recall of judi-

cial decisions. (5) He favored and extended civil service reform, worked for efficiency and economy in government, especially urging a budget system and advocating pensions for Federal employees. (6) In foreign affairs he worked heartily for peace, negotiat-

ting treaties for arbitration and the judicial settle-

ties, which were rejected by the Senate. By "dollar diplomacy" the administration sought to secure opportunities for trade and the investment of capital. This policy was denounced by some as leading to imperialistic interference in the affairs of weaker nations, and making government diplomacy a mere agent of big business.

Some of these views were too progressive to suit the old leaders, and yet it was not long before the insurgent Progressive-Republicans were denouncing the President as too friendly with reactionary party bosses and big business, and a deserter from progressive standards. Believing in the necessity of party government, the President did feel it necessary to work with and through the party machinery in promoting his policies. For a time he withheld patronage from insurgent senators and representatives, and when he changed his policy the damage had been done. The defense of the Tariff Bill, the dismissal of Pinchot, the repeated vetoes of later tariff reduction bills, the veto of the grant of statehood to New Mexico and Arizona because of radical provisions in their constitutions, all increased his unpopularity. The elections of 1910 gave the Democrats a majority in Congress and showed a popular discontent with the old Republican rule and a drift toward Progressive Republicanism or toward the Democratic party. In Congress the insurgent Republicans often joined the Democrats to defeat the regular Republicans. In 1910 Roosevelt returned from a trip to Africa, and before long was openly taking issue with the policies of his successor. By 1911 the Progressive Republicans were planning to prevent the renomination of Taft. At first La Follette was to be their candidate, then they turned to Roosevelt. Early in 1912 he agreed to accept the nomination. In the States having direct primaries Roosevelt made a much better showing than Taft; but the control of the party machinery by the regulars brought about the President's renomination. The Progressives started a new party, ensuring the overwhelming defeat of the President in November and the election of Wilson.

The outstanding feature of the administration was the conflict between conservative and progressive forces; but the confusion and recrimination should not obscure important developments during these four years. Among these were the reform of the rules of the House of Representatives (1910); the Corporation tax (1909); increased powers of the Interstate Commerce Commission; Postal Savings Bank (1910) and Parcel Post (1912); Children's Bureau (1912) and Department of Labor (1913); publicity for and limitation of campaign contributions on income tax and direct election of senators.

Since 1913 Mr. Taft has been Kent pro-

fessor of law at Yale University, lecturing on constitutional law in the college and the law school. He has continued to take an active
interest in promoting international peace and a League of Nations. During the World War he was joint chairman of the National War Labor Conference Board.

With the calming of factional bitterness, Mr. Taft has gained again in the public esteem and confidence, and the accomplishments as well as the mistakes and difficulties of his administration appear in a better perspective.

ARTHUR P. SCOTT,
Assistant Professor of History, The University of Chicago.

TAGABAWAS, tā-gā-bā'-vās, a Philippine people living on both sides of Dávao Bay, Mindanao, a mixture of several Malay tribes.

TAGACAOLOS, tā-gā-kā'-o-lōs, a Philippine tribe, whose settlements are scattered among other tribes along Dávao Bay, Mindanao.

TAGALS, tā-gāl's, TAGALOOS, or TAGALOS, a Philippine people of Malay origin, inhabiting chiefly Mania, the provinces of Cavite, Batāán, Bulacán, Batangas, Infanta, Laguna, and Mindoro, and scattered among other tribes in several other provinces. They are Christians and one of the leading peoples of the archipelago, both in numbers and in culture; they possessed an alphabet and considerable civilization before the arrival of the Spaniards. They were the leading element in the last insurrection against Spain, and proved troublesome after American occupation. They are, however, intelligent, shrewd and generally industrious; and when once comprehending American ideas prove trustworthy. See PHILIPPINE ISLANDS.

TAGANROG, tā-gān'-rōg', Russia, a town in the government of Ekaterinoslav, on a lofty promontory on the Sea of Azov, opposite the mouth of the Don, 28 miles west-northwest of Azov. There is a monument to Alexander I, who died here; also churches, exchange, gymnasia, etc. It has manufactures of candles, leather, tobacco, macaroni, etc. The harbor, though the deepest in the Sea of Azov, is shallow, not admitting vessels which draw more than 10 feet; but its situation secures to it a considerable trade. The principal exports are wheat, rye, barley, oats, linseed, rapeseed, wool, oil, fish, flour and butter; the imports include fruit, oil, machinery, hides, petroleum, dry goods, wine, etc. The annual exports previous to the World War averaged over $50,000,000. Pop. 71,000.

TAGBANUAS, tāg-bānoo'-as, native tribes of the Philippine Islands inhabiting the island of Palawan. They may be classified into five groups, some more civilized than others, according to the nature of the locality and the extent of contact with the coast tribes. The Tagbanuas Apurahmuos have a peculiar writing and alphabet. They have an elaborate system of laws for the regulation of morals and 'fast days. Their god is Diwata, the protector and representative on earth of the Balahan, who may be either a woman, Vincemó, M. H., 'Man and Cat Creators of the悬挂s and Other Tribes of the Island of Palawan, Philippines,' in Journ. Amer. Micr. and Miscellaneous Collections,' Vol XI 1907, 84 pp, Washingto, 1907.

TAGBILARAN, tāg-bē-lā-rān, Philippines, pueblo, capital of the province of Bohol; on the southwest coast. Opposite the town is the important dependent island of Panglao, separated from Bohol Island by a strait one mile in width. The chief industries are agriculture and turtle fishing. Pop. 11,000.

TAGESS, tā'-jēz, in early Italian mythology, son of a minor local deity, or genius, and grandson of Jupiter. He taught the arts of augury and divination, and was said to have sprung forth from a cloud of earth freshly turned up by a husbandman named Tarchon, in the neighborhood of Tarquinii.

TAGGART, Marion Ames, American writer for young people: b. Haverhill, Mass., 7 May 1866. She has published 'The Blissylvania Post Office' (1897); 'Aser, the Shepherd' (1899); 'The Wyndham Girls' (1902); 'In the Days of King Hal' (1902); 'Nut-Brown Joan' (1904); 'Pussy Cat Town' (1906); 'Betty Gaston' (1910); 'Nancy the Doctor's Little Partner' (1911).

TAGGART, Thomas, American congressman: b. County Monhyan, Ireland, 17 Nov. 1836. He came to the United States in 1861 and settled at Xenia, Ohio. He engaged in the hotel business at Indianapolis in 1877, and since 1886 has been active in politics. He was chairman of the Democratic State Committee in 1892-94; mayor of Indianapolis in 1895-1901; and in 1916 was appointed to fill the vacancy in Congress caused by the death of B. J. Snively. He was elected to Congress in 1912 and in 1914.

TAGISH, a tribe of American Indians formerly residing about the headwaters of Lewis River, Alaska. A remnant of the tribe still exists.

TAGLIONI, tāl'-yō'-né, Maria, Italian ballet dancer: b. Stockholm, Sweden, 23 April or 18 March 1804; d. Marseilles, France, 23 April 1884. Her father was Filippo Taglioni (b. Milan, 1777; d. 1871), a ballet master at different opera-houses successively in Europe. She was rigorously trained by her father and developed a marvelous grace, so that she became the admiration of Europe in her day. She made her début at Vienna in 1822; appeared at Paris in 1827, and at Berlin, London, and other capitals later. Her style was termed 'ideale'; was chaste and refined in distinction to the 'realistic' dancing of her predecessors, Gardel and Vestris. Her great successes were 'La Bayadère,' 'La Sylphide,' composed for her by her father, and 'La Fille du Danube.' In 1832 she was married to Count Gilbert de Voisins, and in 1847 retired from the stage. She is frequently mentioned in contemporary literature, particularly by Balzac and Thackeray.

TAGORE, tā'-gōr, Sir Rabindranath, Hindu poet: b. Calcutta, 1861. His father Maharshi Devendranath Tagore was a famous spiritual leader who helped to distinguish for many generations throughout India. He was educated chiefly under private tutors and at the age of 17 visited England. By this time he was writing verse, largely imitative of the old Vaishnavite. When he was 18 years old he published 'Sandhya-Sangita' (Songs of Sunset), and 'Pravata-Sangita' (Songs of Sunrise). In these he aims to the height of neo-romanticism in Bengali poetry. In 1864 he was married and went to
TAGUS — TAHEQUAH

in the banks of the Ganges to manage his estate. There he came into touch with the life of the people and wrote poems, always telling dramatic tales of their affairs. His best known works of verse are 'The Crescent Moon,' 'Gitanjali,' 'A Home in the World,' and 'The Hungry Child.' This second or third period of his life, which lasted 17 years, was a period of great happiness and succeeded quickly death, his wife, daughter and the son of his two sons. At the age of 40 he began work at Bulpur, which centred in school, 'Shanti Niketan,' or a transitory phase of life. He was the first of two boys it had grown in four years to 20 boys by 1919 numbered over 200 boys, while strictly Indian in its character, embodied in itself, in forms modified by the influence of the world to-day, while also the best traditions of the ancient and the modern schools. It is interesting to note that the self-governing students are rapidly diminishing in number and that the chief exports, whose value in 1902 amounted to $800,000. Papeete, on the northwest coast, is the French administrative capital for all the French possessions in Polynesia. The native Tahitians were once a splendid race, noted for their simple, idyllic life. (See TAHITIAN LITERATURE.) The vices introduced by contact with civilization soon brought about moral and physical degeneration, and the native inhabitants were rapidly diminished in numbers. The island was discovered by a Spanish navigator, Quiros, in 1605, and visited by Captain Cook in 1769. In 1842 it came, as a native kingdom, under French protection, and in 1880 was declared a French colony. Pop. about 12,000. See SOCIETY ISLANDS.

TAHITIAN (tā-hē-tān) LITERATURE.

As mentioned under Tahiti, the natives of this southern Pacific island were once a beautiful race, living a natural, simple and idyllic life, as expressed in the accounts of Tahiti by Wallis, Bougainville, Cook and others, and idealized in the works of Melville, 'Omoo' (The Rover); Stoddard, 'Idylls'; and Loti, 'Marriage.' Notwithstanding their physical and moral degeneration since the introduction of European civilization, the evidences of the primitive state of existence, outside the region of early explorers, are to be found in their traditions and legends preserved in the native songs and poems of the existing Teva family, of royal lineage, descended from Hototu, first queen of Vaiere, who married a European, the first king of Punaia. The songs, generally of love, war and lamentation, locally called hīmenes, are sung as a kind of choral chant with a monotonic buzzing bass, on which a high shrill cadencing is repeated indefinitely, holding always in a long ile-i-e-e. The longer poems recite the history of the family, the various forms of etiquette and addresses for visits; shorter poems consist of soliloquies, laments, reproofs and ceremonial topics. Among favorites of which English translations have been made are the 'Coronation Song of Pomare'; 'Lament of Aromaiarai'; 'Soliloquy of Tcura, a beauty asked to wed Punu, an old chief'; and 'Song of Reproof, at the beginning of the Wars between Teva and Puni, in 1768.' Consult La Page, 'Tahitian Literature' (p. 1439, Vol. XXIV); 'Warner's Library of the World's Best Literature.'

TALEQUAH, tā-lē-kwā', Okla., town, former capital of the Cherokee Nation, in the valley of the Illinois River, about 18 miles east of Fort Gibson, and 25 miles north of Muskogee, on the Saint Louis and San Francisco Railroad. It is in a fertile agricul-
tural region. It contains two public high schools, the Cherokee National Female Seminary and the Cherokee National Male Seminary. The latter was founded in 1847. There are two mission schools, the Baptist and the Presbyterian, and two school libraries. There is one bank and four weekly newspapers. The manufacturing is increasing, and there are grain elevators, cotton gins and flour mills. Pop. (est.) 3,000.

TAHOE, tâ-hô', a lake in the base of the Sierra Nevada, on the boundary between California and Nevada, part in Placer County, Calif., and part in the counties of Douglas and Ormsby, Nev. It is about 20 miles long and from 8 to 12 miles wide, and has an altitude of 6275 feet, and an extreme depth of 1,650 feet. The outlet is Truckee River. Lake Tahoe is noted for its beauty and the picturesque surroundings. It is a favorite and unique summer resort, on account of the cool and healthful climate and the beautiful scenery.

TAHIPANIES, or TEHAPNEHES, an ancient city, mentioned in the Bible (Jer. ii. 10; xiii. 7), usually identified with the Daphne of the Greeks, situated in the north-eastern part of the Delta, about 30 miles south-west of Pelusium. In 1886 the site was explored by Petrie (q.v.), who gives an account of his work in his 'Tanis,' Part II (1887).

TAHR, târ, a wild goat (Hemitragus jemnalaus), found on steep tree-covered slopes along the whole range of the Himalayas from Kashmir to Bhutan. The horns are about a foot long, flattened, with a notched anterior margin; body fawn-brown; the hair of the neck, chest and shoulders hangs to the knees; the female is lighter in color with smaller horns. Its nearest relative is the nigher goat of central India.

TAI-CHU, tî-chou', the former capital of Formosa (q.v.). See TAINAN.

TAI-NGNAN-FU, tîn'gân-fou', China, a city in the province of Shantung, situated 35 miles north-west of Tai-nan, on the railway to Yichau. It has a temple covering a large area, which draws many pilgrims bound for Mount Tai, which is regarded as sacred. Pop. about 75,000.

TAI-TOU, empress of Abyssinia: b. 1853; d. Addis Ababa, 11 Feb. 1918. She was a daughter of the king of Gondar and took an active part in the troublous politics of Abyssinia, and was concerned in all the civil wars and intrigues which ended in the raising of Menelik, whom she had taken for her fifth husband in 1853 when he was simply king of Shoo, to the position of Negus-Neqgusti (emperor) in 1889. At Adowa where the Italians suffered a crushing reverse, she accompanied Menelik to battle headquarters and put her own hereditary troops in the field. During Menelik's long illness she practically governed the country and kept it from internal disorders. On Menelik's death in December 1913, his grandson, Lidj Jassan, a youth of 18 and no blood relation of the empress, became emperor, but failed to maintain order, and largely on this account he was deposed in September 1916, and his aunt, Zauditu, Menelik's older daughter, was proclaimed empress.

TAI-YUAN-FU, tîwán'foo', Chin capital of the province of Shan-si, situate the centre of the province, 260 miles south of Peking. It consists of a Chinese and a Christian section, separated by a high wall. It served as the residence of the emperors and contains a number of magnificent mausoleums. The surrounding region is very fertile and contains rich coal deposits. Pop. over 200,000.

TAIHKOU, Formosa, capital of the It has progressed rapidly since it came under Japanese government in 1895. Systematization was begun in 1919, and in 1919 population was over 100,000. See Formosa.

TAILFER, Patrick, American who lived in the 18th century. He was a pen and emigrated to the newly-founded colony of Georgia in 1740. Later he returned to Connecticut. He is remembered for his authorship of a 'True and Historical Narrative of the Colony of Georgia from the Settlement thereof Until the Present (1741). It is a severe arraignment of James Oglethorpe, the founder of the colony and accuses the general of undue cense of arbitrary authority and of putting personal interests before those of the colony. The work has been the subject of much discussion as to whether it was justified, but it is merely the expression of a group of settlers.

TAILLON, Sir Louis Olivier, Canadian statesman: b. Terrebonne, Quebec, 26 April 1840. He was educated at Masson College, which was called to the bar in 1865. He engaged in practice at Quebec in 1882 and became the leader of the bar. He served in the House of Commons from 1875; was speaker in 1884; Attorney-General in 1884-87; and in 1887 he formed an administration. In 1890 he resigned his seat in the House of Commons after his retirement to private life.

TAILOR-BIRD, an East Indian species of Orthotomus or Sutoria sutorius), one of a genus which exhibit a similarity in structure and habits. The habitat cultivated districts, are dressed in tints, fed chiefly on insects, and are partly in their nest-making. They either dead leaf to a living one or join two boring leaves together, so as to form a hanging pouch, which remains attached to the branch by the leaf-stalk of one of the leaves. The threads which they use are generally of twisted vegetable fibres or natural cotton threads, the bill serving for a in puncturing holes in the leaves and inserting the threads through. Occasionally a large enough leaf be found, the nest a common thing. Two threads are inserted into the leaf. The lower part of the pouch contains the nest, which is a cup of soft moss and is entered from above. The actual ture of this ingenious cradle have not been scientifically observed, although it is certain. The best information is cot to in Humen. 'Nests and Eggs of Indian (London 1890) .
TÁIN BÓ CÚALNGE, THE CUALNGE CATTLE-RAID

The medieval Irish scholars catalogued their native literature under several heads, to one of which they gave the name Táin, by which they meant a "revenge" or "redemption of cattle." The most important tale belonging to this class is the subject of this article. The professional Irish story-tellers also arranged their epic tales according to cycles, one of which was known as the Ulster cycle. This cycle corresponds in a remarkable way to Ulster as the cycle of Conchobar (Connor), the king round whom the Ulster warriors mustered; as the Red Branch cycle, from the name of their banqueting hall; and, finally, as the Cuchulainn cycle, from the name of the champion round whom the saga pivots. The 'Táin Bó Cúalnge' has always enjoyed the reputation of being the most celebrated story of Irish antiquity.

The following is the argument of the Cualnge Castle-Raid. Cuchulainn arranged between Queen Medb of Connaught and her husband, Ailill, as to the amount of their respective possessions. On matching their wealth, they were found to be equal, except that among the king's herds was a lordly white bull called "the White Bull". Medb dispatched her courier to Daré mac Fiachna, a rich landowner in Cualnge (Anglicé Cooley), in Ulster, to ask for the loan of his wonderful bull, called "the Brown of Cualnge." Daré at first granted the queen's request but, incensed at a remark made by one of the envoys, he withdrew his promise and swore that he would hang over the Brown Bull of Cualnge.

Medb straightway gathered a formidable army composed of allies from all parts of Ireland wherewith to undertake the invasion of Ulster and to carry off Daré's bull by force. Now it happened that the expedition took place while the Ulstermen suffered a debility which lasted all winter and the burden of defending the province fell on the shoulders of a striping of 17 years of age, namely Cuchulainn, who was exempt from the curse which had befallen the remainder of the champions of Ulster.

Cuchulainn confronted the foe and agreed to allow them to continue their march on condition that every day they send one of their champions to meet him in single battle. When he shall have killed his opponent, the host shall halt and pitch camp until the following morning. Queen Medb agrees to abide by those terms. In each of the combats which ensue, the heroic youth is victorious and slays many of the most celebrated warriors on the side of Connaught. The severest of all those single fights was the one which lasted four days and in which he had as antagonist his early friend and foster-brother, Ferdiad. After the death of Ferdiad, Queen Medb, impatience with having to always have of ancient Irish warfare and overran Ulster with fire and sword.

By this time the Ulstermen have come out of their debility and gathered their forces. In the face of a work of art like the 'Cualnge Cattle-Raid,' it is not a finished epic, but an epic in the making, showing better perhaps than any other work in literature the development of popular tradition through more than a thousand years and the earlier stages of an epic. It affords a picture of "an old barbaric civilization," with

Irish annalists about the time of the birth of Christ, that is to about 300 years before the introduction of Christianity into the island, and such has been the constant Irish tradition. It belongs to a period when agriculture was little known, although the possession of land to place upon it was of first importance and when cattle-raids were of frequent occurrence. The general condition of culture described in the saga corresponds with that part of the age to which archaeologists have given the name La Tène, or Late Celtic, and which terminated at the first century of our era.

The 'Táin Bó Cúalnge' even carries us back to one of the earliest and most widespread beliefs of the great linguistic family to which we belong, to one of the most primitive aspects of a world-wide nature-myth. Its great protagonist, Cuchulainn, is the incarnation of a god, who appears to personify warmth and light struggling against the powers of cold and darkness. In the earliest version of the story, he is the son of the supreme god Lug and a mortal woman. Hence the curious combination that we find on the one hand he acts like a brave and courtly warrior; on the other, his supernatural exploits exceed the course of ordinary human existence. By the time the tale had been given an historical framework and had been consigned to writing, the mythological idea from which it had sprung was, at most, but dim and uncertain. The story-tellers and their hearers regarded Cuchulainn and the other characters of the saga as real Irish men and women, and, although we are not to look for historical accuracy in the saga in every particular, it is very likely that, in the main, the events narrated really took place and the protagonists really existed.

The whole spirit of the 'Táin Bó Cúalnge' is strongly pagan, which is another proof that the tale was committed to writing very early in the Christian period. It is not the work of any one man, but the epic of all Ireland, the accumulated work of generations, the last stage of a slow evolution. The literary form may have taken place as early as the 5th century and its shaping, substantially as we have it, dates from the first half of the 7th century, if not earlier. The earliest manuscripts containing it probably disappeared during the Viking invasions, with the result that the oldest extant version dates from the year 1100. From that date till the middle of the last century a score or more of manuscripts have preserved it. Consequently, the 'Táin Bó Cúalnge' is the most ancient epic tale of western Europe and its composition antedates by a wide margin the epic tales of the Anglo-Saxons, the Scandinavians, the Franks and the Germans. Furthermore, it is entirely original and contains not the slightest hint of any foreign derivation.

The 'Táin Bó Cúalnge' is in prose interspersed here and there with verse and is not a work of art like the 'Cualnge Cattle-Raid,' but it is not a finished epic, but an epic in the making, showing better perhaps than any other work in literature the development of popular tradition through more than a thousand years and the earlier stages of an epic. It affords a picture of "an old barbaric civilization," with
all its inherent imperfections and roughness, wild phantasy and extravagance of deed and description, as it arose and developed among the people, was given form by poetic art. Withal it evokes poetic worth and contains some passages which are not surpassed in any literature.

The ‘Tân Bò Cualnge’ is a great tale, one of the greatest and most curious in the world, and of the utmost importance to the philologist, the folklorist, the archaeologist and the historian. For the first time in Europe it brings to light a high and romantic chivalry. It is a tale that is worthy of any literature in the world and no other race with which the Celts may be compared is able to produce any such ancient indigenous literary monument.

**Bibliography.**—The text of the Tâin, from the most important manuscripts, has been published by Ernst Windisch, ‘Die Altirische Heldensage, Tâin Ferta Cualng,’ Irische Texte, Etschband (Leipzig 1905), which contains complete apparatus, introduction, notes and vocabulary; Faraday, L. W., ‘The ‘Cattle-Raid of Cualnge’ (London 1904) is a translation based on the only manuscript of the letter, E. Cuchulainn Saga (London 1808); contains a translation by Standish H. O’Grady; Hutton, M. A., ‘The Tâin, An Irish Epic Told in English Verse’ (Dublin 1907) is a paraphrase, as is Gregory, Lady A., ‘Cuchulain of Muirtheimne’ (London 1903); on ‘The Ancient Irish Epic Tale, Tân Bò Cualnge, The Cualnge Cattle-Raid’ (London 1914) is the first complete version in English and (pages xxxii—xxxvi) contains a full bibliography on the subject.

**Joseph Dunn,**
Professor of Celtic Languages and Literatures,
The Catholic University of America.

**TAINAN, tî-nân,** Formosa, Japan, a city situated on a small river near the southwest coast of the island. Until 1896 it was the capital of the island. A canal connects it with Formosa Channel. Under the Chinese and Japanese regimes it has had the status of a treaty port. There are a rice mill and several sugar mills. Pop. 53,790.

**Taine, tan,** Hippolyte Adolphe, French critic and historian; b. Vouziers, Ardennes, 21 April 1802; d. Paris, 5 March 1893. He was educated at the Collège Bourbon and the Ecole Normale, Paris, was assigned by the government, which thought his talent dangerous, to a provincial post as instructor, but resigned this and devoted himself to literature, writing in quick succession ‘Essai sur La Fontaine’ (1853; rev. ed. 1860), ‘Essai sur Tite Live’ (1854) and ‘Philosophes Français du XIXe Siècle’ (1856). In 1864 he was appointed to a professorship in the Ecole des Beaux-Arts, where his series of lectures on the history of art were patterns of philosophical criticism. The dissolution of the empire and the attendant troubles directed him to the study of the philosophy of history and in connection therewith he wrote his ‘Origine des Lumières’ (Ancien Régime), 1876, ‘Revolution,’ 1878-84, ‘Régime Moderne,’ 1890—unfinished, a work of great erudition, in which he condemns the royalists, but finds their gravest faults repeated by the republicans, which makes his bitterest attack on Napoleon. Thus he alienated all parties, holding all responsible for the disasters of the ‘Terrible Year.’ A work more far to readers in the United States and England, by Van Lennep, ‘Histoire de la littérature anglaise’ (Englische Texte, Etschband (Leipzig 1905), which contains complete apparatus, introduction, notes and vocabulary; Faraday, L. W., ‘The ‘Cattle-Raid of Cualnge’ (London 1904) is a translation based on the only manuscript of the letter, E. Cuchulainn Saga (London 1808); contains a translation by Standish H. O’Grady; Hutton, M. A., ‘The Tâin, An Irish Epic Told in English Verse’ (Dublin 1907) is a paraphrase, as is Gregory, Lady A., ‘Cuchulain of Muirtheimne’ (London 1903); on ‘The Ancient Irish Epic Tale, Tân Bò Cualnge, The Cualnge Cattle-Raid’ (London 1914) is the first complete version in English and (pages xxxii—xxxvi) contains a full bibliography on the subject.

TAINANT, Charles Sumner, American inventor; b. Watertown, Mass., 25 April 1816; d. Boston, 14 February 1890. He invented the graphophone and was associate inventor of the radiophone. In 1881 he was made a member of the United States delegation sent to the South Pacific to o the transit of Venus. In 1881 he received a gold medal at the Electrical Exhibition, for his inventions in connection with the telephone and in 1889 was given the French emy decoration, ‘Officier de l’Instruction Lique’ for the invention of the graphophone in 1890. He received the John Scott Medal of the Franklin Institute for this same invention of the graphophone in 1890.
THE TAJ MAHAL
n, who raised a formidable rebellion
1851 and who until his suppression
as looked upon by his disciples as
the Taiping — signify
Peace, and the Tien Wank — Heav-
of the Tien Kwo — Kingdom of

Tait, Archibald Campbell, English
bishop of Canterbury: b. Edin-
1813; d. Addington, 1 Dec. 1882.

President of the University of Glasgow in 1847,
the Church in 1851 he was appointed to the see
He declared the archbishopric of
and in 1869 was appointed arch-
He at first opposed the
estabishment of the Irish
on being appealed to personally by
accepted the inevitable.
was sental in securing the enactment of
Worship Regulation Act of 1874, as
of a calm statesmanlike cast, and
coolness and dignity in the criti-
his time, such as the Essays and
traversy, the Colenso case and the
ation of Ritualists. He was looked
High Church party as a mere Eras-
him of unfairness, but in
lays he vindicated his sincerity in
charitable tolerance with unmis-
considered. Davidson and Ben-
Archibald Campbell Tait (1891); En-
Catholic Revival in the
ury' (London 1914).

John Robinson, American painter:
1810; d. 1909. He
ed at Bethany College, Va. (1852),
in Florence, Italy (1853-56); in
(1859-71); and in Munich (1872-
as for several years the art critic
York Mail and Express. Among
are 'European Life, Legend and
(1859) and 'Dolce far Niente'

Melbourne McTaggart, Cana-
b. Melbourne, 20 May 1842. He
ed at Saint Francis College, Rich-
graduated at McGill University,
1862. He started practice as law-
Rochmond, then joined the legal
te (1870), remaining his law
years. He was created K.C. in
lected treasurer of the Montreal
7 he was appointed puisne judge
Quebec Court of Appeals, Quebec,
Montreal in 1889. In 1906 he was
justice of the Supreme Court. He
the occasion of the Queen's
Jubilee (1897). A founder of the Children's
Memorial Hospital, he has been its president
1905.

Tait, Peter Guthrie, Scottish physicist: b. Dalkeith, 28 April 1831; d. Edinburgh, 25 July 1901. He was educated at the Edinburgh Uni-
versity and at Saint Peter's College, Cambridge. Elected Fellow of Peterhouse in 1852, he be-
came professor of mathematics at Queen's Col-
lege, Belfast, two years later, and held that
office till his appointment in 1860 to the chair
of natural philosophy in the University of
Edinburgh. He published 'Dynamics of a
Particle' (1856); 'Quaternions' (1867);
'Thermo-Dynamics' (1868); 'Recent Advances
in Physical Science' (1876); 'Heat' (1884);
'Light' (1884); 'Properties of Matter' (1885);
'Dynamics' (1895); 'Newton's Laws of Mo-
tion' (1899), etc. He was joint-author with
Lord Kelvin of a well-known 'Treatise on
Natural Philosophy', and also collaborated
with the late Balfour Stewart in 'The Unseen
Universe'.

Taito, ti-wan', the native name for
Formosa (q.v.).

Taj Mahal, tāzh, ma-hāl', India, a cele-
brated mausoleum in a beautiful garden, out-
side the city of Agra, about a mile east of
the fort. It was built by the Emperor Shah Jahan
for himself and his favorite wife Mumtaz
Mahal, who died in 1629. Tavermier, who saw
the building in process of construction, says
that 20,000 men were employed upon it con-
tually for 22 years. It is an octagonal building
70 feet high, with sides measuring 130 feet,
and is surmounted by a dome giving an addi-
tional height of 120 feet; total height, 190 feet.
At the four corners of the platform centred by
the mausoleum are minarets 133 feet high. The
whole is built of white marble, and the interior
decorations are of sumptuous magnificence.
The screen surrounding the chamber contain-
ing the cenotaphs of the emperor and his con-
sort, above the sepulchral vault, is composed of
12 kinds of stones, chief of which is the
valuable lapis lazuli; the arabesque mosaic and
inlaid work is described as of unsurpassed
beauty. The cost of the mausoleum is vari-
ously estimated to have been from $10,000,000
to $50,000,000.

Tajura, or Ta'jurah, tā-joorā, northeas-
Africa, a bay and seaport in the
French Somali Coast protectorate or territory
of Obock, on the Gulf of Aden. It was ceded
to France in 1884. The rising French seaport
of Jibuti is at the entrance of the bay, on the
south side, whose a railway extends since 1902
to Harar. See Asvrasint.

Tak-i-Kesra. See Ctesiphon.

Takahashi, tā'-ka-hā-shē, Korekiyo,
Ban fills, Japanese financier: b. Sendai, 7 July
1854. He studied English in Japan, then, for
one year, in America. In 1875 he was ap-
pointed principal of the Osaka English School,
becoming (1881) official in the Department of
Agriculture and Commerce. In 1892 he en-
tered service of the Bank of Japan, becoming
the following year director of its western sec-

in 1895 he entered the Yokohama Specie
Bank as manager, becoming, successively, di-
ector (1896), vice-president (1897), and was
then appointed vice-governor of the Bank of
Japan, returning (1906) to the Yokohama
Specie Bank as president while retaining his former position. From 1904-06 he negotiated important loans from England and America. He was created baron in 1907.

TAKAHIRA, taka-hēra, Kogoro, Baron, Japanese diplomat; b. Iwate, 1854. He was appointed attached to the legation at Washington in 1879 and became secretary in 1881. Later he was made chargé-d'affaires at Korea, then consul-general at Shanghai and (1887) New York, following which he was successively appointed Minister-Resident to Holland and Denmark, Minister-Plenipotentiary at Vienna, Vienna and Berne. From 1901-05 he was minister at Washington, in the latter year signing, with Baron Komura, the Peace Treaty at Portsmouth, N. H. He was Ambassador at Rome (1907), then transferred to Washington the following year, serving till 1909.

TAKAMINE, taka-miń, Jokichi, Japanese-American chemist; b. Takaoka, Japan, 3 Nov. 1854. He was graduated in chemical engineering (1879) at the Engineering College of the Imperial University at Tokyo, becoming Japanese government student at the Glasgow University and Andersonson University, Glasgow, from 1879-81. From 1881-84 he was head chemist of the Department of Agriculture and Commerce, Tokyo; then (1884-85) Imperial Japanese Commissioner to the Cotton Centennial, New Orleans. In 1887 he organized and erected the first super-phosphate works at Tokio. He came to America in 1890 where he brought to the attention of the public the process to practical use producing diastatic enzyme, now used in starch factories. He established a research factory in New York, and with others, formulated a process of extraction of the active principle of the suprarenal glands on a commercial scale, producing 'adrenalin.'

TAKAMATSU, taka-māt-soo, Japan, the capital of the prefecture of Kagawa, situated on the north coast of Shikoku. Pop. 40,000.

TAKAOKA, taka-ōka, Japan, a town in the prefecture of Toyama near the west coast of central Honjo. It manufactures dyes and hardware. Pop. about 40,000.

TAKASAKI, taka-sā-ke, Japan, a town in the prefecture of Gunma, situated nearly in the centre of Honjo, 60 miles northwest of Tokio, with which it has railroad connection. It has cotton and silk manufactures. Pop. 34,900.

TAKATA, taka-ta, Japan, a town in the prefecture of Niigata, near the west coast of central Honjo. It has extensive manufactures of cotton goods. Pop. 32,600.

TAKIGRAPHY. See SHORTHAND.

TAKILMAN FAMILY, a tribe of American Indians occupying the country along the Rogue River in Oregon. In 1860 there were some 17 villages of this tribe but it is now scattered or extinct.

TAKOW, tā-kow', or TA-KAO, tā-ō-o', Formosa, a port on the southwest coast, connected by rail with Taihain. Its principal export is sugar. Pop. 15,000.

TAKU, a tribe of North American Indians, residing in the vicinity of Taku Inlet, Alaska. They number about 300.

TALACOGAN, tā-lā-kō-gān, Philippines, a settlement of Moros, province of Surigao, Mindanao, on the Agusan River, seven miles of the outlet of Lake Pinatay, and 96 miles of Surigao, the provincial capital. Pop. 16,500.

TALAMANCAS, tā-lā-mān-kā, Pana name formerly applied to the Atlantic region of western Panama and Costa Rica. At the time of the Discovery the region was inhabited by numerous tribes with a partially civilized form of their own. They manufactured a great variety of ornaments of gold, and the accounts of the explorers concerning the friendship and hospitality of the whites they were driven in forest and mountain recesses. Here a known as Talamancans still lives in primitive independence and wholly unaffected by civilization within a short distance of Panama Railroad.

TALAVACHI, a mysterious poison manufactured by the Aztecs, and by handed down to the Mexican Indians. Fully administered, it is said to destroy mind while leaving slight effects on the body. The peculiar effect of the poison seems to induce monomania or epilepsy.

TALBOT, Arthur Newell, American geologist; b. Cortland, Ill., 21 Oct. 1857. He graduated (1881) at the University of Illinois, receiving his civil engineer's diploma in geology. He has been engaged in engineering work on railroads, sewerage, waterworks and other public utilities as well as in the investigation and construction of materials. Since 1890 he has been professor of civil engineering at the University of Illinois. He was elected president of the American Society of Civil Engineers. He has written "The Railway Transition Spiral" (1893); "Tests of Concrete" (1901); "Tests of Concretes" (1912); "Tests of Reinforced Concrete" (1913).

TALBOT, Ethelbert, American Protestant Episcopal bishop; b. Fayette, Mo., 9 Oct. 1816. He graduated from Dartmouth College in 1870, and from the General Theological Seminary in 1873. He was ordained in the Episcopal church in the year last named and was rector of Saint James, Macon, Mo., 1863-87. In 1873 he was consecrated missionary bishop of Washington and Idaho, and in 1879 was translated see of Central Pennsylvania. After admiring the diocese of central Pennsylvania for seven years he accomplished his division in the diocese of Bethlehem of which he was bishop with residence at South Bethlehem and the diocese of Harrisburg. He is the author of "My People of the Plains," "Bishop Among His Flock," and "Tim: a Tabor of a Dog." Besides these he has published various sermons, addenda, and tracts.

TALBOT, Henry Paul, American chemist; b. Boston, 15 May 1854. He was graduated (1885) at the Massachusetts Institute of Technology and obtained Ph.D. diploma at L. in 1890. He has served successively as assistant (1885-87), instructor (1887-88 and 1892-93), associate professor (1893-95), and professor of chemistry (1896-1902) at the Massachusetts Institute of Technology, where he has since charge of the department of chemical engineering. He has written...
y Course of Quantitative Chemical (1817); 'The Electrolytic Dictionary,' in collaboration with A. A. d (1905); besides numerous articles in the scientific journals.

**BOT, John, 1st Earl of Shrews:** about 1380; d. Castillon, France, 173. He was appointed lord-lieutenant of France by Henry V in 1414. Five years began a long career in the French wars, at the siege of Milan in 1420, and Meaux in 1421. He returned to Ireland-lieutenant in 1424 and was knighted out in 1427' went again to France. After the siege of Orleans he determined the town of Beaugency; but the place had already been evacuated, and northward toward Patay, where for the French and captured. He regained his freedom by exchange. In 1436 he became a marshal of France, 1439 had become governor and lieu-tenant of France and Normandy. The of Harfleur in 1440 was largely due to 1445 he conducted Queen Margaret to and that year went for the third time d, where to his titles were added those of Waterford and Lord of Dungarvan. He crossed the channel again as lieu-tenant of Normandy. In 1453 he went to the siege of Castillon, and against great odds until he was killed.

**BOT, John, American Protestant missionary:** b. Wymondham, Norfolk, 1645; d. Burlington, N. J., 29 July. He entered Christ's College, Cambridge in 1664, f Freethinker, Gloucestershire, in 1695, red the employ of the English Society Propagation of the Gospel in Foreign Parts. He came to America, founded the Church, Burlington, N. J., and rector 1704-22. His later loyalty to the Church appears to have fallen into for the two sides of the controversy. His 'History of the Church in Bermuda (1876),' and Perry, 'History of the Episcopal Church' (1885).

**BOT, Silas, American naval officer:** on, Bristol County, Mass., 1751; d. New June 1813. Upon the breaking out of the War he was commissioned in a Rhode Island regiment, and after the siege of Boston, accom-panied the army in 1776 to New York. For the which he directed certain operations the British shipping in the harbor he from Congress a major's commission. He participated in the memorable defense of Boston, November 1777, and in 1778 ren-ovable assistance to General Sullivan by tiring the American forces from the to the upper end of the island of Savannah. He was promoted to the rank of major in 1778 of the British floating Pigeon of 22 guns, anchored in one of the necks commanding the approach to New- n 1779 he was commissioned captain, and was assigned to a vessel with success British commerce, was captured by a fleet and confined in the Jersey prison. He was afterward removed to England, and in 1781 was exchanged. Upon the reorganization of the navy in 1794, he was again called into the public service, and superintended the construction of the frigate Constitution (Old Ironsides), which in 1799 was her flagship during a cruise in the West Indies. He resigned his commission in 1801, and passed the remainder of his life in New York. Consult Tuckerman, 'Life of Commodore Silas Talbot' (1851).

**TALBOT, William Henry Fox,** English photographer and scientist: b. Lacock Abbey, near Chippenham, England, 11 Feb. 1800; d. there, 17 Sept. 1877. He was graduated at Cambridge in 1821, and represented Chippenham in Parliament 1833-34. Scientific research being more attractive to him he gave up politics, and, devoting himself to the study of the chemical action of light, made important discoveries in photography. In 1839 his invention of pho-togetic drawing was explained by Faraday to the Royal Institution, and in 1841 he patented the calotype process. He is still referred to as an authority whose statements are sound. Subsequently Talbot devoted himself to antiquarian research, being one of the first decipherers of the cuneiform inscriptions from Nineveh. His publications include 'Chemical Changes of Color' (Phil. Magazine 1828); 'Legendary Tales' (1830); 'Hermes, or Classical and Antiquarian Researches' (1838-39); 'The Pencil of Nature' (6 vols. on photography 1844-46); ' Assyrian Texts Translated' (1856), etc.

**TALBOT, or OLD SOUTHERN HOUND,** a race of dogs, probably extinct, which seems to have been the original stock from which the various breeds of hounds sprang. The color was pure white; large head, very broad muzzle, long pendulous ears and rough hair on the belly. Talbot is the family name of the English house of Shrewsbury which has a talbot for badge and two talbots for supporters.

**TALC,** one of the commonest and most important of the non-metallic minerals. It is usually massive or foliated, the laminae being flexible but not elastic. It is number one in Mohs scale of hardness, and like most very soft minerals it has a greasy feel. It is pearly and glimmering, and its usual colors are green, gray or white. Foliated varieties are often quite transparent, while the massive is translucent. It is of average specific gravity, about 2.7. It is acid magnesium silicate, \(\text{H}_2\text{MgSiO}_3\). Talc, like the related mineral serpentine, is of secondary origin, having been formed by the alteration of various magnesian minerals such as tremolite, pyroxene and enstatite. It occurs in metamorphic rocks all over the world, being the most prominent mineral in the rock known as talcose schist, and sometimes forms extensive beds, occurring thus in most of the Atlantic Coast states. Although very soft, it is almost indestructible, not being attacked by acids nor injuriously affected by water. Its common, massive form, popularly known as "soapstone," is the "estatite" of mineralogy. Some soapstone is, however, a massive pyrophyllite (q.v.) and the term soapstone is applied loosely by miners to almost any soft rock or mineral with a greasy feel. Talc is used in the arts either powdered as "flour talc," or in sawed pieces. Flour talc is employed as a base...
for fireproof paints, in boiler and steampipe coverings, and foundry facings, for electric insulators, in the manufacture of dynamite, and of wall papers to which it imparts a glossy surface; it is very extensively used in the manufacture of toilet powders, and cheap soaps, for dressing leathers and skins, and as a base for lubricants. About half a million dollars' worth of "fibrous tale" is produced annually in the single county of Saint Lawrence in New York. This material is a mixture of tale and fibrous tremolite and is used in making paper. When ground the fibres cause the retention of the flour tale in the paper pulp, thus adding materially to the strength and weight of the paper.

The supply of pure, compact soapstone, the most valuable variety of tale, comes largely from western North Carolina and Virginia. It is sawed into slate pencils and crayons and is manufactured into the tips of gas burners. The chief uses of soapstone are for stationary wash-tubs, sinks, acid tanks, hearth-stones, fire bricks, newel posts and many other articles of everyday use. "French chalk" is a fine-granular tale used as a crayon by tailors. In China and Japan a fine compact tale is carved into various ornaments, household gods and pagodas, though the material thus used is azagatalite (quartz) or pyrophyllite. See MINERAL PRODUCTION OF THE UNITED STATES.

TALCA, tāll'kā, Chile, the capital of the province of the same name, on the Rio Claro, about 180 miles south of Valparaiso, on the railway from Curico to Concepcion. It is a fine city with handsome churches and a lycceum. Weaving is the chief manufacturing industry. Pop. (1913) 41,618. The province has an area of 3,964 square miles and the population is 131,058.

TALCAHUANO, tāl-kā-wā'no, Chile, a seaport in the province of Concepcion, situated 200 miles south of Valparaiso, and eight miles west of the city of Concepcion, with which it has railroad connection. It has a lighthouse, a new custom-house, a wireless station, and large warehouses and docks. The harbor is being fortified. It is the principal export town for wool in Chile. It was severely from earthquake in 1835, but was rebuilt. Pop. 21,876.

TALE OF A TUB, A, and THE BATTLE OF THE BOOKS. Swift's "A Tale of a Tub" was written for the most part about 1696, but was not published till 1704, when it appeared as a volume with "The Battle of the Books." The author wittily dedicated it to Prince Posterity, and to this day it has generally been regarded as one of the two or three great prose satires in English. Not the least interesting parts of it are the diverting chapters on critics and criticism and on madness, in which the theory is advanced that happiness consists in being well deceived. Its most fruitful fancy is of the sect who took the tailor for their exemplar, and to him it was to be a large suit of clothes — the term of Carlyle's "Sartor Resartus." The allegorical narrative presents the fortunes of three brothers, Peter, Martin and Jack, standing respectively for the Roman, the Anglican and the Nonconformist. Their father on his death-bed bequeathes them each a coat with two virtues: "One is, that with good bearing they will last you as long as you live. The other is, that they will grow same proportion with your bodies." The time the boys wear their coats in age with their father's will. Later they go to town and fall in love with the three most in reputation, the Duchess d'Orgueil and Madame de la Salle, and the Vicomte and Marquis de la Homemade. Desiring to be in the field, they violate their father's will, covering with shoulder-knots, silver fringe and embroidery. Peter becomes dictatorial. Jack resists being addressed by his brother Peter, Father Peter and finally as Peter. Martin and Jack revolt from authority, and, in token of repentance, at remove the embellishments from the in which process Martin, reforming, restores his garment to its original state, but Jack in a fury rends his from top to bottom. It is asserted that he had written as a good man, ridiculing only Popery and Diaseitts were delerious. Anglicans were alarmed at its implication; it is undeniable that its disgusting and brutal levity was inimical to the cause of religious reverence. The satire was explained by William Wotton; but explanations were maliciously seized upon to make it serve as annotations in subsequent editions. As an old man Swift is said to have exclaimed: "Good God, what a genius when I wrote that book!"

"The Battle of the Books," written 1697, was Swift's contribution to the literary controversy of the 17th century, regarding the relative merits of ancient and modern writers. In England the di menace was rendered rather insignificant by the confusion of the champions, the wits appearing as defenders of the ancients, the great classical scholar of the leader of the moderns. The conflict was settled by the "Letters of Phalaris," which William Temple, in his "Essay Upon the Ancient and Modern Learning" (1692), declared the more of grace, more spirit, more force and genius than any others I have seen since ancient or modern. Leibnitz, "Letters of Phalaris," said Temple, is one of the finest ancient books in prose that we possess. Temple, championing the moderns in 1694 with "Reflections Upon Ancien" and "Modern Learning." In 1695 Charles brought out an edition of the extolled in behalf of the ancients. In 1697 Wotton published a second edition of the "Reflection", including an essay by the learned Richar ley, showing that the "Letters of Phalaris" were forgeries and, relatively, much about this point Swift comes in with book of the Books," written for the the ancients and in support of his Temple, the immediate object being to laughter of the town upon Wotton as a fellow. Swift was on the wrong side with the Phalaris question and with re the scholarship of the enemy. But he a flight of nicely pointed arrows at the politer and kinder criticism and vanity of the moderns, and the course of the dispute between the the Bec he strikes out an idea and with which Matthew Arnold adopted and pop
as the epitome of his gospel of culture—
*sweetness and light.* Consult lives of Swift
by Samuel Johnson, Sir W. Scott, J. Forster,
H. Craik, L. Stephen, P. M. Simon, etc.; and
Saintsbury's *History of Criticism*; Spingarn's
*Critical Essays of the Seventeenth Century*;
*Cambridge History of English Literature*;
(Vol. IX).

STUART P. SHERMAN,
Professor of English, University of Illinois.

TALE OF TWO CITIES, A, published in 1859, was the second of Dickens' historical novels and is to-day more popular than the author's earlier novel of the same kind, 'Barnaby Rudge' (1841). The reason lies partly in the fact that the French Revolution is a more permanently interesting historical event than the anti-Catholic agitation and the Gordon riots in London. The chief purpose of the novel is to give an impression,—in this case a very English impression with its roots in the anti-Napoleonic tradition,—of the days of the old Régime and the French Revolution, in which cynicism, arrogance and cruelty, on the one hand, and guillotining, on the other, were the prominent features. No account is suggested of the intellectual causes of the Revolution. It is a picture of action. The turbulence of Paris compared with the dignified and law-abiding ways of London give the book its title.

The story is the account of the escape from France of the emigré, Saint Evremonde, or Charles Darnay, of his return to France, his arrest, condemnation through the unwitting evidence of his own father-in-law, and his final escape through the self-sacrifice of Sidney Carton. This last is the most famous part of the book, both ethically and episodically. Sidney Carton, the real hero, takes advantage of his resemblance to Charles Darnay to mount the scaffold in place of the latter, who is meanwhile hurrying disguised to England with his family. The story is a moving one and is almost wholly lacking in the usual humorous scenes and characters of the author. It has been successfully dramatized. Certain of the scenes, notably the flight from Paris, the death of Carton, and the women knitting differentiately at the executions, have become famous.

WILLIAM T. BREWSTER.

TALENT, the name of a weight and denomination of money among the ancient Greeks, and also applied by Greek writers to various standard weights and denominations of money of different nations; the weight and value differing in the various nations and at various times. The Attic talent as a weight contained 60 Attic mina or 6,000 Attic drachmae, equal to 36 pounds, 11 ounces, British Troy weight. As a denomination of silver money it was equal to $1,220. The great talent of the Romans is computed to be equal to $500, and the little talent to $375. A Jewish weight and denomination of money, equivalent to 3,000 shekels, also receives this name. As a weight it was equal to about 93¾ pounds avoirdupois; as a denomination of silver it has been variously estimated at $1,500 to $1,880.

TALES OF THE ARGONAUTS, The. The Tales of the Argonauts is a volume of short sketches collected and published by [Francis] Bret Harte in 1875; but the title is sometimes loosely applied to all this author's stories of early California. Nothing in the 'Tales of the Argonauts' proper quite equals in merit 'The Luck of Roaring Camp,' 'The Outcasts of Poker Flat' and 'Tennessee's Partner,' which had appeared in an earlier collection; but 'An Iliad of Sandy Bar,' 'How Santa Claus Came to Simple Simon's Bar,' and 'Harte's' Argonauts have been deservedly popular. The Argonauts are of course the gold-seekers of 1849 and the years immediately following. These adventurers came from all quarters of the globe and all ranks of society, and they had in common only the possession of the strength and determination necessary to reach the new Colchis. Here they lived, at first, wholly free from the conventional restraints imposed by an organized society, and each man showed himself for what he was. Many of these primitive social conditions still existed when Harte went to California in 1854, and they made a great impression on the observant boy. He did not use them in literature, however, until he was able to look back on them in his experience. Californians objected that his pictures were unreal; but they give the impression of essential truth to life—a more serious work not spoiled by his persistent habit of showing the good elements in even the lowest and most debased characters. Harte occasionally seems to have adopted some of the less fortunate devices of Dickens, but his manner was chiefly his own. He lacks literary finish, though he was painstaking in regard to style; but in these early tales he has a sure command of humor and pathos, and a complete mastery of his unique material.

WILLIAM B. CAIRNS.

TALES OF THE CRUSADERS, two novels by Sir Walter Scott, respectively entitled 'The Talisman' and 'The Betrothed.'

TALES OF A GRANDFATHER, a collection of stories dealing with the history of Scotland, by Sir Walter Scott, and published in four series in 1827–30.

TALES OF HOFFMAN (Les Contes d'Hoffmann), Opera comique in prologue and three acts by Jacques Offenbach (libretto by Eugène Scribe and Barbier), first produced at L'Avenue in Paris, in several months after the composer's death. In spite of the unparalleled success which Offenbach had achieved with his light-hearted, clever and unfailingly melodious *opéras bouffes*, he evidently desired to bequeath to posterity a work of more serious artistic import; and he spent his most ambitious efforts and years of his life on the 'Tales of Hoffman.' As his end approached, he begged the manager to produce it in time for him to witness the première. While he did not live to see it, the public took to the work no less heartily than to the operettas and it will undoubtedly outlive them. The story is novel and cleverly put together. The prologue shows Hoffman and his fellow students in Luther's Inn at Nuremberg, and proceeds to tell of his three love encounters and these form the three succeeding acts. The opera ends as it began, Hoffman acclaimed a hero by his admiring friends. Inspired by its romance and fantasy, Offenbach has written a genuine and attractive score, which displays his talent for melody-making and ingenious characterization at its best. The barcarolle, in the second act, once heard, is never to be forgotten. Alone it
TALES OF MY LANDLORD—TALIAFERRO

would have made the opera, but there are many other numbers worthy of recall—
the burlesque ballad of Kleinzach, sung by Hoffman in the prologue and epilogue, Nicklausse's song of the doll, the automaton's song, *Les oiseaux dans la chance* and Antonio's romance, *Elle a su,* and the trio finale of the third act. Offenbach's treatment of the dramatic situations is always clever and at times subtle. The orchestration, while simple, is refined and the general effect is a great deal above that on which he was usually content to stand. In Europe, *Tales of Hoffman* has been pursued by superstitious fear on the part of the managers owing to the fact that its first performance at the King Theatre in Vienna was the occasion of a conflagration which caused great loss of life. Its revival in New York by Oscar Hammerstein in 1907 proved that its original appeal is still potent.

LEWIS M. ISAACS.

TALES OF MY LANDLORD, a name applied to four series of Scott's novels, the first embracing 'Old Mortality' and 'The Black Dwarf'; the second, 'The Heart of Midlothian'; the third, 'The Bride of Lammermoor,' and 'A Legend of Montrose'; and the fourth, 'Count Robert of Paris,' and 'Castle Dangerous.'

TALES OF A TRAVELLER, a well-known work by Washington Irving, published in 1824. It is a delightful medley of humorous and tragic elements and the author himself declares to be "moral tales," with the moral disguised as much as possible by sweets and spices.

TALES OF A WAYSIDE INN. The 'Tales of a Wayside Inn,' by Henry Wadsworth Longfellow, was published in three parts, in 1863, 1872 and 1873, respectively. The poet followed the old plan of presenting a series of stories as told by different persons—in this case by friends of the author who, though they were not named, were so plainly characterized as to be easily recognizable. Among those of wider fame are Ole Bull, the violinist, and Thomas William Parsons, the poet. The inn is the "Wayside Inn" Old Red Horse Inn at Sudbury, 20 miles from Cambridge—a favorite resort for parties from Harvard College. Each of the three parts has a prelude and a finale, and there are interludes which link together the tales and introduce the narrators. Most of the stories were derived by Longfellow from his wide reading—many of them from the legends of continental Europe, a few from American sources. The 'Birds of Killingworth' was developed from a slight hint that it may fairly be said to be of the poet's own invention. Longfellow, while not a poor story-teller, was hardly at his best in narrative, particularly in narrative with vigorous action, and the 'Tales of a Wayside Inn,' taken as a whole, is not to be listed among his most distinguished works. A few of the Tales have, however, won a place for themselves. Among these are 'Paul Revere's Ride,' told by the landlord, and 'King Robert of Sicily,' which is ascribed to the Sicilian.

WILLIAM B. CAHNS.

TALESMAN. From the Latin *talis*, such, or of such a kind and quality. A talesman is a juror summoned to fill up a panel for the trial of a particular case. A default appears to have but one immediate result, common law, that is to select *tales de standibus* (those by-holders who are tent) in sufficient number. A number of statutes forbid summoning standers but the procedure is main, in most jurisdictions, and the method is legal unless forbidden by statute. It appears to be no set limit to the number of the emergency roster on which one could be drawn or of the panel being exhausted and delirious jurors existing. Talesmen can only be called for a single trial, not for a Talesmen are considered strictly as jurors, not called to form a new panel. In some States it has been held that one may be made up entirely of talesmen all the panel has been discharged or to some other case or when a "challenger array" has been sustained, but such action has been denied and the usual employed is to issue a new venire.

TALFOURD, täl'verd, Sir Tho. The English poet: b. Reading, 26 May 1770, Ford, 13 March 1854. He was called to the bar in 1821, but was early called to bar by literary labors as a contri- various periodicals. In 1835 and 1837 he returned to Parliament as one of the peers for Reading; and between these years his Covent Garden his tragedy of 130 tragedies subsequently written by him are 'The Athenian Captive'; 'Glencoe, or of the MacDonalds'; and the 'Cabinet' of these had the same success as the drama of his excellence lies more in the language and sentiment than in the dramatic action. In 1849 he was raised to the Court of Common Pleas. He died suddenly while on grand jury. Besides the dramas above to, he was the author of 'Life of Lamb' (1837); and the same in a larger edition (1848).

TALIAFERRO, töl'é-ver, William American soldier and lawyer: b. B Gloucester County, Va., 26 Dec. 1822; and at William and Mary College, baniested from the latter in 1841. He studied law, and was engaged in the practice profession until 1847, when he became in the United States infantry, later promoted major, and in August 1848 entered out and resumed his law practice. In the outbreak of the Civil War he beca in the provisional army of Virginia, he was promoted brigadier-general in the federal army and in 1865 major-general commanded at Gloucester Point, Va., in most of the battles of the Army of Virginia until March 1863, when he was in charge of the district of Savannah, July 1863 he was in command of the defense and defenses on Morris Island, at the charge of Fort Wagner (q.v.) against a combined land and naval attack. Later command of the district of South Carolina. He was elected to Congress at the lature and served 10 years during the construction period. He was prominent in Masonic fraternity and was Master of the Masons of Virginia in 1876-77.
ESIN, British hard or minstrel of

tury. To him are attributed about

which many critics consider of later

consult Skene, 'Four Ancient Books of

1868'; Guest, 'Mabinogion' (1877).

'M, tâ-lêm', an island of the Philip-

the centre of the Bay Lagoon, Luxun,

island, on the southern end of the

province of Rizal by a channel

if a mile wide; length from north to

1 miles; width, four miles; area, 20

iles. A central mountain range tran-

se island from north to south; there

es along the coast on each side. Build-

es is obtained in the mountains and

anala.

POT, a palm (Corypha umbraculifera)

and India, remarkable for possessing

at inflorescence of any plant. The

cylindrical trunk takes over 50 years

its full height; during 30 of those

leaves spring from near the ground,

ward the palm grows rapidly until it is

It then sends up from the centre

crown a gigantic, pyramidal flower-

with a main rachis over 30 feet long,

zen branches reaching so far out that

of the panicle also is about 30 feet

These branches terminate in many

s and twigs, and are covered with

00,000 greenish-yellow, dioecious bloss-

ich have so powerful and disagreeable

that the tree is often cut down at this

so soon as the tree begins to bloom the

e, and by the time the flowering

bout a month) has ended, they have

fallen off, leaving the bare, ringed

wned only by the inflorescence. After

ime the fruits, which are inedible, are

and fall in great quantities, and the

e dies down, having lived to produce

single exhausting crop.

aves also are gigantic, one alone being

of sheltering 10 persons comfortably.

e prickly stalks six or seven feet long

more or less circular, with radiating

ture and strength of rattan, and

arrow segments which are joined to-

early to the tips, and can be folded

They can be easily marked with

and used as writing material;

extant by the natives and Buddhists.

cious texture when dry, and

ble for thatching houses, for umbrel-

basketry, and are carried before

e of rank. In times of famine the

e felled, for the sake of their pith,

duces a kind of sago.

SAI, tâ-le'sj, Philippines, pueblo,

of Cebu, on the east coast, six miles

of Cebu, the provincial capital. It is

rt branch of the coast highway con-

t with towns to the north and south.

00.

are also two smaller pueblos of the

ne: (1) in the province of Ambos

, Cebus, two miles northwest of

p. 3,560; (2) in the province of Ba-

zon, on the north shore of Lake

(Taal), 26 miles north of Batangas;

pass from Batangas to Cavite; the

try is fishing; pop. 2,500.

SMAN, a small object presumed to

astrological or mystical charm that

may protect or guard the owner in some way.

It was usually of stone or metal and bore an

carved figure, and gained its suggested value

because of certain ceremonies, at some particu-

lar moment, as at the culmination of a certain

star or at the conjunction of certain planets.

The talisman was supposed to exercise super-

natural influences over the bearer or owner,

particularly in averting disease. The nature of

the talisman has been very different among dif-

ferent nations. The Egyptians made use of

images of their gods and of sacred animals,

such as the ibis and the scarabaeus; the Persians

used the phylacteries inscribed with passages

from the Old Testament (a section of the cabala

is devoted to teaching the construction of talis-

mans); the Greeks used little tablets having

written upon them various magical words, such

as the Ephesian words, or those written on

the feet, the girdle and the crown of the statue

of Artemis at Ephesus; the Romans employed

various idols, which they suspended upon

the body by chains; the Arabs and Turks made

use of sentences from the Koran; and we also

find in the East medals of particular metals

struck under a particular constellation and

marked with magical signs. In the Middle

Ages astrology and the knowledge of the

tances of talismans and amulets formed an im-

portant part of medical science; and the quacks

of modern times sometimes have recourse to

similar means. The talisman differs from the

amulet, in that it does not require to be worn

or carried, but like Aladdin's lamp will work

wonders. See FETISH.

TALKING MACHINE. The wonderful,

though natural, growth in popularity of the

talking machine has caused its manufacture

and sale in the few years that have passed since

its perfection to become a truly great industry.

Its utility for entertainment purposes in the

home no doubt aids in the absorption of most

of the instruments constructed in the compet-

ing factories, but the use of talking machines

in commercial life (dictaphone perhaps in par-

icular), greatly aids the numerical demand and

it is found a valuable aid in teaching foreign

languages. History mentions talking machines

as early as the 13th century, when Albertus

Magnus, the philosopher and scholar, is said

to have produced a mechanism that reproduced

the human voice. A queen of Sweden is said

to have had a head which talked automatically

in Hebrew, Greek, Latin and French. The

Reverend John Wesley writes in his journal at

date 26 April 1762, that he saw an invention at

Lurgan, Ireland, of startling capabilities. It

was "an automaton of an old man in a case

over against a clock . . . Every time the

clock struck he opened the door with one hand,

drew back the curtain with the other, turned

his head, but then said with a clear, loud

articulate voice, 'Past one, two, three' and so

on." The invention was contrived by a man

named Miller. But so many visitors called

from foreign parts to see this wonder, and no

one offered to purchase it, that it took up his

time so much he nearly failed in business; he

"took the whole machine to pieces." This

Miller told the preacher later he had made

very successful experiments and could make a

man who could talk and sing hymns, but he

was too busy on other work. In 1783, Abbe

Mical presented to the French Academy of
Sciences an invention that talked, but he later broke it up, having religious scruples.

In 1877 Thomas Alva Edison brought out his first talking machine. The contrivance was of the simplest, being merely a steel point fixed to the centre of a flexible disk and a revolving cylinder behind the point. It was first displayed in Paris. The invention was enclosed in a little box about a foot square and the record was made on a piece of tin-foil. As a woman's voice was first used, it created great admiration. In 1888 Edison constructed his phonograph with its diaphragm having the lateral movement instead of the cylinder and the sheet of tin-foil was discarded in favor of a cylinder of wax, the vibrations being recorded with a tiny chisel. Edison is said to have gained his incipient conception of a talking machine while working with automatic telegraphs operating at high speeds. He made some experiments with embossed strips impressed with dashes and dots thereon which were moved rapidly beneath a stylus to vibrate it. He observed the stylus made audible sounds while vibrating, and as the great inventor never passed by mechanical facts, however trivial, that did not appear to the ordinary investigator, he became interested in this curious sound phenomenon. He was about this time working on telephone experiments and the idea of a new sound developer occurred to him as a possibility. The conception of developing a talking machine soon grew in his mind and under his expert hands he soon had his first talking machine—getting his first patent 19 Feb. 1878, No. 200,521, with its tin-foil records.

The graphophone was an outcome of much experimentation by laboratory experts and at its inception the sewing machine was becoming a highly popular home machine. Therefore the manufacturers at first used the sewing-machine stand (frame, treadle and table top) in their first output, as motive power which was manufactured in the East Bridgeport vacated building of the Home Sewing Machine Company. It met with poor success and the spring motor was invented which made it portable and sales grew rapidly. Next the cylinder form of record was developed and then the flat record. The listener had been using a number of tubes for the ears: these gave way to the horn for the dissemination of the sound leaving the ears naked and the sound audible at a distance. Later again the unguarded horn and all the mechanism was enclosed in a box or a cabinet.

Emil Berliner invented the gramophone apparatus in 1892 with a smoked disc and stylus to produce sound vibrations. See GRAMOPHON, GRAPHOPHONE, PHONOGRAPHER, etc.

**TALL FESCUE.** See GRASSES IN THE UNITED STATES.

**TALL OAT-GRASS.** See GRASSES IN THE UNITED STATES.

**TALLADEGA, Tal-ä-de'ga.** Ala. city, county-seat of Talladega County, on the Southern, the Birmingham and Alabama, the Louisville and Nashville and Atlanta, Birmingham and Atlantic railroads, about 70 miles east of Birmingham and 100 miles north of Montgomery. The city is in a fertile agricultural region, in which there is also considerable mining. The chief industrial establishments are three cotton factories, two machine shops and grist mills, the $200,000 chemical plant, cottonseed-oil mill, three lumber and planing mills. There is considerable trade in grain and cotton. The educational institutions are the Synodical Female College, Alabama Academy for the Blind, Alabama School for the Deaf-Mutes, Alabama Institution for Deaf, Dumb and Blind, and Talladega College (colored), opened in 1869, under the auspices of the Congregational Church, and public schools. There are several churches and one orphanage. The two national banks have a combined capital of $150,000. State bank $50,000, deposits over $1,000,000. Pop. about 5,854.

**TALLADEGA, Battle of, in the War of 1812.** On 7 Nov. 1813, four days after the battle at Tallushatchee Jackson learned that 160 friendly Creek Indians in Lashly's Fort at Talladega, about 30 miles south of Fort Strother, were besieging some hostile warriors and were in danger of capture. Accordingly, with 1,200 infantry and 800 cavalry, he set out and on the 9th had approached within 80 yards of the Indians before he was discovered. Jackson arranged his plan of battle so that the Indians would be surrounded, but in the fight three companies of militia gave way and allowed many Indians to escape. Jackson's victory was decisive, 290 of the enemy being found dead on the field while his own loss was 15 killed and 85 wounded. Jackson returned to Fort Strother 10 November where he was forced to remain idle until the battle of Emuckfaw (q.v.). Consult Brackenridge, H. M., 'History of the Late War,' pp. 190-191; Lossing, 'War of 1812,' pp. 762-763; Wiley and Rines, 'The United States,' Vol. V, pp. 448-449; biographies of Jackson by Parson (Vol. I, pp. 440-444); Buell (Vol. I, pp. 305-310) and Frost (pp. 142-346).

**TALLADEGA COLLEGE,** located Talladega, Ala. It is open to all persons without regard to color or race, but is primarily for the education of colored students. The work is arranged to meet their needs. It was founded in 1867 by the American Missionary Association (Congregational), aided by Freedman's Bureau; and was the first open to colored pupils in Alabama; the university was obtained in 1869. A farm was bought in 1877, additions to it were made in 1887 and until the land owned by the college in about 800 acres. The college is coeducational and aims to secure the best development of social character by the association of students of both sexes under the same general discipline and careful supervision. The college organization includes seven departments. The educational department offers three courses, the classical course including the study of the Biblical languages, Hebrew and Greek, leading to the degree of B.D.; the English course, the same as the classical without the study of the Bible in the original languages; the Bible training course of two years, including the usual study of the Bible without the other studies of the usual theological course. The college department offers two courses, the classical and the scientific, leading to the degrees of A.B.
and the college preparatory depart-
ments two corresponding courses of three
years each in the high school for boys and
girls, beginning in the first year and
graduating in the third year. The col-
lege preparatory department is com-
posed of three years of college prepara-
tory work, the first year being used as
the first year of the college prepara-
tory course. It includes practice work in
the primary grades, and the intermediate
grades. The departments are organized
and taught in all grades, in addition to
which the college preparatory depart-
ments are in charge of the housekeeping
in the dormitory, the girls' industrial
house, and in the department of agriculture.
In the manual training department,
the girls are taught woodworking,
drafting, in the eighth grade in forge-
ing, in the ninth grade in sewing and
dressing, and in the tenth grade in cooking.
Instruction is given to students in the preparatory
courses of the college in agriculture and
manual training. The buildings are situated
on high ground a mile from the city; they include
the main college building, the hall (theological building),
Foster Hall (dormitory), Stone Hall (men's dorm-
itory), and Cassedy School (primary and inter-
grades). The Sluder School (for boys' industrial
building), the De Forest Chapel, and the Seaboard
Air Line railroads, are east of Pensacola, Fla., and
163 miles Jacksonville. It is in an agricultural,
fruit-growing region and ships con-
veniently. The chief industries are cotton
crops, cotton gins, railroad shops, novelty
and cigar factories. There are 10
six of which are for the colored
students. The educational institutions are Florida
College for Women which has a school
attached, founded in 1887; West
Seminary, University, founded in 1888;
and the Florida Agricultural College, founded in 1889.
There are three libraries. Tallahas-
see has five banks, three State banks and two
banks, capital $220,000; surplus $56,250.
An electric street and interurban railroad was
granted in 1915. It is about 220 miles long and
navigable for 100 miles.

TALLAHASSEE—TALLEYRAND-PÉRIGORD

TALLAHATCHIE, tál-a-hāch'ı, a river
which has its rise in Tippah County, in
northern Mississippi, flows southwest, and enters Greenwood with the Yocoma to form the Yazoo
River. It is about 220 miles long and
navigable for 100 miles.

TALLAHATCHIE, Battle of, in the War
of 1812. When news of the massacre at Fort
Mims (q.v.) 30 Aug. 1813 reached Nashville,
Tenn., Gen. Andrew Jackson (q.v.) collected
2,500 infantry and 1,000 cavalry, crossed Tennes-
see into what is now Alabama, on 23 Oct.
1813 established a camp called Fort Deposit
and early in November reached the headwaters of the Coosa. Learning that the Indians had
posted themselves at Tallishatchee on the south
side of the Coosa, about 13 miles distant, Jackson
sent Col. John Coffee with 920 troops to
destroy them. By a rapid march Coffee reached the
Indian camp 3 November and was boldly
charged by the Indians but repulsed them and
killed all, about 200 in number, with a loss to
himself of 5 killed and 41 wounded. Jackson
then moved toward Talladega (q.v.). Consult
Brackenridge, H. M., 'History of the Late
War,' (p. 190); Foy, H. A., 'Official Ac-
counts,' (pp. 143-145); Loring, 'War of 1812' (pp.
758-763); Wiley and Rines, 'The United States'
(Vol. V, pp. 447-448); biographies of Jackson
by Parson (Vol. I, pp. 430-438); Buell (Vol.
I, pp. 302-304) and Frost (p. 132 et seq.).

TALLAPOOSA, tál-a-poo'sa, Ga., city in
Haralson County, on the Southern Railroad
near the Alabama line, about 53 miles west of
Atlanta. It is in an agricultural region, in
the vicinity of pine forests. There is considerable
industry in the vicinity and near the city are
large vineyards. Its industries are connected
with the culture and shipping of tobacco, cotton,
farm and lumber products, and mining. There
are banking facilities and newspapers.

TALLAPOOSA, a river which has its rise in
Paulding County, Ga., and flows southwest
into Alabama. It unites with the Coosa about
five miles north of Montgomery and forms the
Alabama River. It is about 245 miles long and
navigable for 40 miles.

TALLEGAILA. See MEGAPODES.

TALLEYRAND-PÉRIGORD, tál-a-rō'n (Eng.
tall-ř-ând) pā-rē-gör', Charles Maurice
de, French diplomatist: b. Paris, 13 Feb. 1754; d. there, 17 May 1838. Although the eldest of
three brothers he was, in consequence of lame-
ness, prevented from entering the army and
destined, against his will, for the priesthood.
He commenced his studies at the College d'Har-
court, continued them at the Seminary of Saint
Sulpice and at the Sorbonne, and completed
them at Rheims, where an uncle of his was
archbishop. His life of restless activity is
naturally divided into three parts: namely, from
his consecration as bishop (1789) to his hani-
ishment by the Convention; from that period to
the Peace of Paris 1815; and from the return
of constitutional government to his death. In 1788, when only 28, he was appointed general agent to the clergy, and in 1790 he was consecrated bishop of Autun. As he found his spiritual functions inadequate to satisfy his ambition, he attached himself to Mirabeau, then connected with the Minister of Finance, Calonne. Here his political career began Mirabeau recognized his ability to the highest degree. Hitherto Talleyrand, at the court of Versailles, had displayed all the qualities of a polished, witty and gallant courtier. But he now left the court party and joined the Republicans, and on the meeting of the States-General was elected deputy for Autun, and voted soon after they opened for merging the three estates into one national assembly. In vain the court tried to stop him in his career. After the storming of the Bastille he was chosen by the national assembly one of the 63 notables of the State. In the Conciergerie Talleyrand, Sieyès, and Sailly, the Society of the Friends of the Constitution, out of which the Jacobin Club afterward arose. He soon retired from it, however, as too extreme, and in 1789 founded the society known as the Club des Feuillants. Here he exerted himself for a monarchy, surrounded by democratic institutions. On 16 Feb. 1790, he was elected president of the national assembly; and on 14 July of that year, the first anniversary of the fall of the Bastille, participated in that capacity at the July festival in the Champ de Mars. About this time he was the author of various important administrative proposals, a registration scheme which was adopted, and forms the basis of that still in force in France, and a plan of a system of public education which was of great service to the subsequent assemblies which took up the problem. When the civil constitution of the clergy was framed he gave his adhesion to it and he ordained the first Protestant clergy. For this he was immediately excommunicated by a Papal brief, and embraced the opportunity to renounce his episcopal functions (April 1791). On two occasions in 1792 he was sent to London charged with diplomatic functions, although bearing no official position. After his return on the second occasion (August 1792), he was accused of cherishing royalist sympathies, but Danton rescued him and sent him back to London (September). But the charges against him proved foolish, and at the Convention he was placed on the list of emigrants, which precluded his return to France. His power under the Directory was now forever lost, although by the intervention of Madame de Stael the decree against him was recalled in 1795. After his arrival in Paris the opposition which he met with from Carnot prevented him from being employed, and kept him in bad odor. At last, by exerting himself in the Constitutional Club, he succeeded in 1797 in gaining the Ministry of Foreign Affairs; but he was suspected of keeping up an understanding with the agents of Louis XVI. He was obliged to resign in July 1799, and his downfall as a republican was complete. But he had early recognized Bonaparte as the coming man in France and after the latter's return from Egypt did much towards making the critical event of the 18th of November 1799 (10 Nov. 1799) when the Directory was overthrown and the Consulate began. Appointed Minister of Foreign Affairs, he took the lead in the negotiations by which the Treaties of Luneville and Amiens were concluded, in 1802. He had married a Mrs. Grand, with whom he had been living for some years. They were in 1813. He became, in the course of the Napoleonic idea, was a chief of the murder of the Duc d'Enghien, and after the establishment of the empire in 1804 was appointed to the office of chamberlain. In December 1805, after the conclusion of the campaign against Austria he negotiated the Peace of Presburg; and following year exerted himself for the election of Louis Bonaparte to the Dutch throne. On 6 July 1806, he was created Prince of Beaulieu. After the battle of Friedland, he decreed a Royalist committee, and in conjunction with Fouche began to intrigue for Napoleon's fall. From this time on, the issue of the Russian expedition, he placed himself in communication with Louis XVIII, the Congress of Châtillon, received the congress of Russia into his hotel, and on 1 April established a provisional government, himself at the head of it, and procured Napoleon's abdication. He afterward exerted himself very effectually in re-establishing Louis on the throne of his ancestors. He was at Congress of Vienna when news arrived that Napoleon had landed from Elba. He took an active part in the declaration then issued charing Napoleon as a disturber of the peace. In 1815 the Allies again entered Paris. I became president of the council with the office of Foreign Affairs; but as he resigned the second Peace of Paris he gave resignment. With the commencement of consular government in France and the internal connected with it Talleyrand's principles were properly concluded. In the first years of the Restoration he often appeared at court and gave good counsel, of which the court profited; but as he often voted with the opposition, defending freedom of the press, and condemned the English campaign of 1823. When he saw the rocks on which the nation would be wrecked, he retired from public life, keeping open house, and giving a reception to all who had distinguished themselves either by literary or political servitude, with his social intercourse Talleyrand always relished the grandeur of old times. Not indolent he worked as little as possible. He was well acquainted with the art of others to account and get them to work. In ordinary business he was more ease, and skillfully skimmed the surface of things, but he did not hesitate to speak on the spur of the moment or in important emergencies. Probably this is why he adopted the adoption of one of his favorite axioms, never to explain one's self. He was accustomed to say,
been often said long before him, usage had been given to man to en-
to conceal his thoughts. On the occas-
a, atROb to the breach in his belief.

Louis Philippe, however, cepting the throne, asked his advice, vied the short answer that he should When, by the revolutions in Belgium ed, in connection with other circum-
the July throne became, endangered, d at last came forward, and finally ng the old dynasty and his own work th Louis Philippe for the maintenance ace of Europe. In September 1830 he Ambassador to London, and made all exer	
tions calculated to show off the intentions of the July dynasty. To ly was it owing that Austria and Prus-
the conferences of the three powers d decided the fate of Greece, and that less protocols the powers united in ws with regard to Belgium. After ilts he turned to what had long been idea, the formation of a combina-
France, Britain and Austria against The plan was partly successful when he subscribed the quadruple alliance ties to which were France, England, I Portugal), which was intended above rd the constitutional principle in West-
. He returned from London in l repeatedly made his appearance at of the citizen-king, where he was re-
th great distinction, and rendered by the an oracle. It is said that before his was reconciled with the Church. The part of his immense property, esti-about 18,000,000 francs, he left to his 
Duc de Dino. He left memoirs tint which were to remain unpublished rs after his death. They have proved value. Consult 'Correspondence Be-
leyn and Louis XVIII1' (1881); e, 'Mémoires Politiques'; Blanc, 'His-
Dix Ans'; Guizot, 'Mémoires'; and, isset, 'Talleyrand' (1894); McCabe, lleynard (London 1900).

TALLIEN, Jean Lambert, zhôn läô-bär
French revolutionist: b. Paris, 1769; d. Nov. 1830. He first made himself nown by publishing a revolutionary alled Ami de Clatory. He soon became he most popular men of the revolu-
arity, and was concerned in the common 10 Aug. 1792. Nominated a deputy to etion from the department of Seine he distinguished himself in that body boience in the process against Louis n objecting to the king's being allowed a defend him. He took part in most guinary proceedings which occurred he ascendency of Robespierre, and sent on a mission to Bordeaux. Here reeked in his sanguinary career by the of Miss de Fontenay, a woman re- for her beauty, who, having been im-
at Bordeaux as she was going to join y in Spain, owed her life to Tallien. her with him to Paris, whither he let, and bore himself before the Convention he charge of moderation. After the ant and his party, Tallien perceived should become one of the next vic-
obespierre if he did not strike the first blow. Accordingly, at the sitting of the Convention of the 9th of Thermidor (27 July 1794) he vehemently assailed Robespierre, and it was od that the influence of his friends was brought to the guillotine. At this period he married his protégée, Madame de Fontenay. Having been nominated a member of the committee of public safety, he used all his influence against his former associates, Fou-
quiere-Tinville, Carrier, Lebon, etc. an demanded the suppression of all the revolution-
ary committees. In 1795 he was sent as commissioner of the Convention to the army of Hoche in Brittany. He subsequently became a member of the Council of Five Hundred, but his influence gradually 'declined. In 1798 he ac-
accompanied Bonaparte's Egyptian expedition. The vessel in which he sailed to return to France was captured by the British, and he was taken to London. On finally reaching France he found his importance altogether gone, and was glad to accept the office of French consul at Alicante. The last five years of his life were spent in poverty in Paris.

TALLIS, or TALLYS, Thomas, English composer of cathedral music: b. about 1514; d. 23 Nov. 1555. He was the author of some of the finest chants in the cathedral ser-
ice of the English Church, and filled the position of organist of the chapel royal in the reigns of Edward VI, Mary and Elizabeth. William Byrd, the distinguished musician, was his pupil, and the two published in 1575 a collection of motets and hymns. Tallis composed settings to the 'Venite Exultemus,' 'Magnificat,' the 'Nunc Dimittis' and other canticles and to the 'Te Deum' as used in the English service, and his works fill a large space in the church music catalogue of Novello.

TALLMADGE, tâl'máj, Benjamin, American soldier; b. Setauket, N. Y., 25 Feb. 1754; d. Litchfield, Conn., 7 March 1835. He was gradu-
ated from Yale in 1773 and became principal of a high school in Wethersfield, Conn. He en-
listed at the outbreak of the Revolution and rapidly attained the rank of major. In 1779 he crossed Long Island Sound and captured 500 Tories at Lloyd's Neck, L. I., and in 1780 suc-
scessfully planned the capture of Fort George at Oyster Bay. He was given command of the Major André and had charge of his execution. Later he settled in Litchfield, Conn., and was me-
ber of Congress from 1801-17. Consult 'Memoirs' by his son (1859).

TALLMADGE, Nathaniel Pitcher, Amer-
ocian legislator: b. Chatham, N. Y., 8 Feb. 1795; d. Battle Creek, Mich., 2 Nov. 1864. He was gradu-
ated (1815) at Union College, then studied law and (1818) was admitted to the bar. He commenced practice at Poughkeepsie, and was sent to the assembly in 1828, serving as State senator from 1830-33, when he was elected to the United States Senate. He was appointed by President Tyler governor of the Territory of Wisconsin in 1844, retiring within a year from office and practising his profession at Fond du Lac. His last years were spent at Battle Creek, Mich.

TALLOW, a somewhat indefinite mixture of the harder and less fusible fats, which is chiefly prepared from the natural fat of sheep and omen. It consists mainly of stearin, olein, and palmmitin, and it is nearly colorless and taste-
less when pure, although the commercial product is commonly yellow. Until the cellular tissues are removed it is termed suet. In the manufacture for tallow, the solids are cut into pieces and boiled with water, the fatty matter then melting and rising to the surface, whence it is removed by skimming. The cellular tissues of the natural fat remain behind, sensibly unaffected; but they are afterward treated by great pressure, to express whatever tallow they may have retained after treatment by the boiling process. The whiter and purer portions of the tallow are used in the manufacture of candles, and the softer and yellower grades are used in the manufacture of soap, as well as for dressing leather, and as a lubricant for heavy machinery. The melting point of tallow varies with the composition of the substance, commonly ranging from 100° F. to 120° F. The specific gravity is usually about 0.93.

**TALLOW, Mineral**, a waxy solid formed of a mixture of the higher hydrocarbons, usually of the paraffin or methane series. Commonly called tallow to indicate a false or impure composition, it may be considered a solid petroleum. It occurs in irregular seams and masses in the earth, in Galicia, in the Caucasus, and in Colorado. After purification it gives a product called cetesine, very similar to beeswax in physical properties. It is used in the manufacture of candles, of insulating materials, of bottles to contain hydrofluoric acid, and as an adulterant for beeswax.

**TALLOW TREE**, any of several trees which yield rather dense fatty substances used like tallow for making candles and soap. The tallow tree or butter-and-tallow tree of Sierra Leone (Fouadelma butyracea) is a member of the family Guttiferae; the oil obtained from its fruit is used like butter. The tallow-tree of Malabar (Fouadica indica) belongs to the family Dipterocarpaceae and is noted for its large leafy leaves sometimes 10 feet long. Its panicles of fragrant white flowers, for the hard, white, scentless tallow of its seeds, and for the "East Indian copal" which is obtained from incisions made in its large trunks. The candlemaker of Matto Grosso in Brazil and in America the tallow tree of China (Napium schiffrum), a member of the family Euphorbiaceae, is probably best known. It has become naturalized in the Southern States, having been introduced in the vicinity of Charleston and Savannah whenever it has extended. It is a large tree with long-stemmed, smooth, ovate pointed leaves, about two inches long; inconspicuous flowers in straight terminal spikes; and hard, smooth, brown three-celled capsules about half an inch in diameter. The hemispherical seeds are covered with a white waxy tallow, and after the capsule bursts hang by threads among the bright red leaves of autumn. They are gathered by the Chinese, crushed and boiled (the capsules also), and the tallow skimmed off. Wax is manufactured from tallow the animal fats are cut three pounds to 10 being the usual proportion. But arts this tree has furnished the Chinese with their candles. Vermilion is often added to color the otherwise white wax.

**TALQVIST, talekvist**, Knut L., Swedish Orientalist; b. Kyrkoslät, 16 March 1865. He studied at the Swedish Normal Lyceum and the University, Helsingfors, then at Leipzig and Berlin. Student was candidate in philosophy (1887), and (1890) and rector of the school of Assyriology and Semitica (1891-99) becoming professor of literature in the latter year. He wrote Sprache der Contract of Nabunaid (1861), Babylonische Schenkungsbriefe (1891), assyrische Briefe (1891), "Arabische Sprichwörte und Spiele" (1891), "Ibn Sa'd Kitab almugrib, Book IV" (1891), and Neubabylonisches Namenenbuch" (1905).

**TALLY**, a stick divided into two halves, formerly in general use as a medium for recording accounts. One-half was kept by the debtor and one by the creditor. When any debt or payment was recorded the two halves were adjusted together, and a new mark made on them both; the method, however inconvenient in other respects, was an excellent security against forgery, it would be difficult, if not impossible, for the creditor to make a false tally corresponding to the counter-tally, in all respects in which the creditor wished them to correspond; so, as not to be detected as false. When a tally was entirely cleared off, the creditor's tally was given to the debtor. Tallies were in use till the 18th century for keeping accounts in chequer of England. In modern usage a tally mark made to record a score may be called a tally.

**TALMA, Francois Joseph, frän-svæ zef tal-ma**, French tragedian; b. Paris, 15 Oct. 1763; d. 19 Oct. 1826. In 1787 he made his début at the Theatre Francais in the character of Seide in Voltaire's Mahomet and was received with applause. Talma rendered an important service to the French stage by introducing dressing in accordance with the time and country of the character represented. Chénier's tragedy of Charles IX, which was brought forward in 1786, and Talma, after studying the character of Charles in history, his person in medals and portraits, excelled in their such truth and life that his realization as the first French tragedian was established beyond dispute. The principal work which he created, or carried to the highest perfection, were Seide, Othello, Hamlet, S Regulus, the grandmaster of the temple of Cestis, Charles IX, Charles VI, Manlius and Or He did not generally excel in comedy. He appeared in 1823 with great success in the character of Danville in Delavigne's "Ecole des Vieillards." Talma was the great favorite of the Emperor Napoleon and accompanied him to Erfurt in 1808 and to Dresden in 1813. He was the author of the very interesting work, entitled Reflections sur Lecain et l'Art Théâtral, and of an autobiography afterward edited and published by Dumas (1849-50).

**TALMAGE, James Edward, American geologist and theologian; b. Hungerford, England, 21 Sept. 1862. In 1876 he emigrated to Utah with his parents who had embraced the...**
of the Latter-day Saints. He was a student at Lehigh University 1882–83; at Johns Hopkins University 1883–84, and was graduated in chemistry from the former in 1891. He received a D.Sc. from the same university in 1912; also honorary D.Sc. and LL.D. degrees from Church of Jesus Christ of Latter-day Saints in 1889. He was professor of geology and geophysicist at Brigham Young University 1884–88; president of the latter institution 1898–99; president of the University of Utah 1894–97; professor of geology and mineralogy and director of the Desert Museum, Salt Lake City 1892–1917. He was one of the delegates from Utah to the Royal Society of Edinburgh of the Congress of Natural Science, Russia, in 1898. He was ordained deacon 1887, teacher 1889, and held the higher offices of the church.
terizations: of "our sulky, sullen dame, nursing her wrath to keep it warm"; of Souter Johnny, "his ancient, trusty, drouthy crony"; of Tam himself, "the heaving, blustering, blathering, bellum." And as in 'Tam o'Shanter' the imagination of Burns is unmarrled by the moralizing and sentimentalizing that so often besets him, so the style, terse, racy, picturesque, illustrates his mastery over his native idiom. Burns himself said of this poem that it "showed a finishing polish" that he "despaired of ever excelling." And we may echo his verdict that the unique quality of 'Tam o'Shanter' is one that he never did excel. Consult Henderson, T. F. (in 'Cambridge History of English Literature'), Vol. XI, and bibliography.

FRANCES W. CUTLER.

TAM-SUI, tám-soóč. Formosa, a seaport on the northern coast of the island at the mouth of the Tam-su River, 10 miles north-west of Tai-pe, the capital. It is the chief export town of the island, and the principal staples are tea, rice, sugar, coal, jute, camphor, etc. Pop. about 7,000.

TAM-TAM, tám tám. See Tom-tom.

TAMA, tâ'ma, Iowa, city in Tama County; on the Iowa River, and on the Chicago, Milwaukee and Saint Paul, and the Chicago and Northwestern railways, about 63 miles north-east of Des Moines and 18 miles east by south of Marshalltown. It is in an agricultural and stock-raising region. An Indian reservation (Sac and Fox) is nearby. The chief manufacturing establishments are flour mills, paper and lumber mills, broom factories, machine shops and cigar factories. The shipments consist chiefly of flour, brooms, poultry, livestock, eggs, vegetables and grain. There are seven churches, public and parish schools, two banks and a library. Pop. 2,900.

TAMAGNO, Francesco, Italian operatic tenor: b. Turin, 1851; d. Varese, 1905. His début on the operatic stage occurred (1873) in 'Un Ballo in Maschera,' at Palermo. Under Abbado he appeared on the New York stage in the season 1889-90 when his name in Europe was a word to conjure with among his patrons. Under Abbado and Grau, season 1894-95, he was again on the boards in New York at the Metropolitan Opera House and Americans were treated to his renderings of 'Otello,' his greatest rôle, which had made such fame in Milan. He retired from the stage in 1902.

TAMANDUA. See Ant-eater.

TAMANOIR, the great ant-eater (q.v.).

TAMAQUA, tâ-mâ'kwa, Pa., borough in Schuylkill County, on the Little Schuylkill River, and on the Philadelphia and Reading, and the Central of New Jersey railways, about 32 miles north of Reading and 15 miles west of Manch-Tunk. It is in a region noted for the quantity and quality of coal deposits. It was settled in 1790, and became a borough in 1853. The chief manufacturing establishments are flour mills, tanneries, machine shops, a powder mill and planing mills. It has large coal yards. There are about 20 factories, paying wages, exact $400,900 annually, with product of over $1,000,000. There are 12 churches, a high school, elementary schools, a business college and a library. There are several banks and newspapers. Pop. 10,000.

TAMAR, tâ'mar, (1) a southern river of England, flowing between the counties of Cornwall and Devonshire; and emptying through the Hoo Moase into Plymouth Sound, and is navigable above Plymouth; length about 60 miles. (2) A river of Tasmania, formed by the union of the North and South Esk, and flowing into Bass' Straits at Fort Dalrymple.

TAMARACK. See LARCH.

TAMARAO, a sturdily built dwarf buffalo (Bos mindorensis) of the Philippines, which stands about three feet and one-half feet high at the shoulders and has coarse, thick, blackish brown hair. "The horns," says Lydekker, "although massive, are comparatively short, and rise upward in the plane of the face with a lyre curvature; they are distinctly triangular, with the largest face in front, and are somewhat roughened. In its massive horns, thick legs and uniform coloration, this species comes nearer to the Indian buffalo than to the auro.

TAMARIND. See MARMOSET.

TAMARIND, a leguminous tree (Tamarindus indica) and its fruit. It is supposed to have originated in eastern tropical Africa, but is now universally cultivated in the tropics. It reaches a height of 80 feet, and has a crown of spreading branches and thick foliage. The leaves are abruptly pinnate, the flowers fragrant, red and yellow, with three perfect petals and four sepals and colored caduceus bracts. They are gathered in terminal racemes. The bean-like fruits are indehiscent flattened pods, and have a brittle brown shell. The seeds are flat, angular and shining, and embedded in a dark-hued fibrous juicy pulp, which is pleasantly acid, laxative and cooling. This fruit is used to prepare tamarind fish, to make acidulous cooling drinks, and is also a spice of commerce; with or without being preserved in sugar. Every part of the tree is used for medicinal purposes, except the yellowish-white, purple mottled wood, which is valuable for turnery, being hard and heavy. The seeds are astrigent, the leaves are employed for curries and for a yellow or red dye. "Velvet" or "black" tamarinds, or black tamarinds, are the product of a small leguminous tree (Dialium guineense), of Africa. It has pinnate leaves on slender branches, and downy black pods, of about the size and shape of a hazel-nut, containing seeds embedded in an edible, farinaceous pulp. The tamarind of New South Wales is a slender sapineceus tree (Cupania anacardioides) of Australia, has an acid fruit and coarse-grained, whitish wood. The wild tamarind is a large tree of Jamaica (Pithecolobium fliciolium), having twice-pinnate leaves; Pithecolobium dulce is the sweet-pulped Manilla tamarind, Certain leguminous trees of Central America and the West Indies, Pentaclethra malacotica and Adenanthera pavonina, are respectively the wild and the yellow tamarind.

TAMARISK, any member of the genus Tamarix which is represented by shrubs, also called "flowertine cypress," inhabiting warm and dry lands, but not hardly in America as far north as Massachusetts. They are salt-loving plants, often growing near the sea that the spray of high breakers dashes over them, and are
Admireable for maritime planting, ne other plants living near salt-water, id steppes, certain species of *Tamarix* age with a punctate appearance, caused te salts. These leaves excrete saline, which in rainless seasons serve to moisture during the cool nights, and its absorption by special cells at the of the tiny cavities. In the daytime, salts cover the leaves with a crust, which protects the plants from excessive ion under the desert sun. The tama-tree (*T. articulata*) of the Indo-region is a bush or small tree looking it like a conifer, which secretes enough water useful in a culinary way; it is also source of tamarisk-galls employed for medi-for dyeing, since they contain 50 per tannin; also an astringent bark.

Risks are generally planted for ornamental purposes, and are somewhat larger than in cold winters the ground. They are of unusual type, with widely spreading, some-thing-like branches, crowded with small k scales. In the axes of these are formed branch-buds, so that the plant exudes new shoots. The flowers are pink, in close spike-like racemes are often panicked, and are softed by protruding stamens. One of the known (*T. gallica*) reaches 15 or m height, with panicked racemes bloom-ete in summer; it is very easily propagated nishes good firewood. A species of the (*T. ×mannifera*) when punctured by a insect (*Coccus manniferus*) exudes honey-sap of sap that harden in the morning; this is gathered and sold to Syrian as manna (q.v.). The German tama- *Myricaria germanica*. It has a wand-like, bluish foliage, and many racemes of k flowers, terminating lateral branches.

*TAMATE*, tä-mä-tāv, the capital of car, situated on a peninsula slightly the middle of the east coast. It is the port of the island and has a good protected by a natural breakwater, and are. A railroad connects it with the rest of the islands, so also canal transportation. Hides, gold a and raffia are the leading articles of trade. There is cable communication with there, Mauritius, Reunion and Aden. re good banking facilities. Pop. 8,647.

*TAULIPAS*, tā-mow-le-pās, Mexico, a the Gulf coast, occupying the north-ermost part of the country. Its area is around 20,000 square miles. The southwestern part is traversed by the eastern Sierra but the greater portion belongs to the coastal plain and a rolling country, gradually to the coast. The latter is h lagoons and sand-bars. The state is by several large streams, and the Rio forms the northern boundary. The cli-climate is hot, and the northeastern e shore is subject to heavy rains on the lower mountain slopes, where is sufficient. There are three railway agriculture and grazing are the chief s. Cotton, sugar and cattle products ried. Tampico (q.v.) is the chief se- seems for steamships connect with Pensa-cola, Baltimore, New York and Havana. The capital is Ciudad Victoria. Pop. 249,641.

*TAMAYO Y BAUS*, tā-ma-yō ē ba-ous, Manuel, Spanish dramatist: b. Madrid, 1829; d. 1898. His parents were actors and the boy traveled about with them and early learned to play his parts on the stage; and thus early gained an insight into the nature and structure of the drama. The natural result was that he soon began writing dramas himself. His first dramatic production, an adaptation of 'Genevieve de Brabant,' was produced successfully when he was only 11 years of age. In this play his mother and himself took leading parts, the first production taking place in Granada. From this time on he continued to write for the stage and to acquire an increasing reputation as a dramatist. At his retirement from this elected a member of the Spanish Royal Academy, and for the last 14 years of his life he was director of the National Library and chief of the board of archivists, librarians and antiquarians. Among his best-known dramas are 'La locura de amor' (1855); 'Lances de honor' (1863); 'Un drama enojado' (1867). The latter, which has been translated into English under the title of 'A New Drama' by J. D. Fitz-Gerald and T. H. Guild (New York 1915) is considered his best drama. Consult Cotarelo y Morl, E., 'Historia Literaria' (Vol. I, Madrid 1901); Sicarás y Salvador, N., 'Manuel Tamayo y Baus' (Barcelona 1906); Tonnenberg, Boris de, 'L'Espagne littéraire' (Paris 1903).

*TAMBERLIK*, täm-ber-lek', Enrico, Italian operatic singer: b. Rome, Italy, 16 March 1820; d. Paris, 15 March 1889. He began his career at Naples as tenor singer in 1841, and in 1850 went to England, where he enjoyed great popularity for 24 years. He visited the United States in 1857. After his retirement from the stage he lived in Madrid, where he engaged in the manufacture of small arms.

*TAMBON*, täm-bo-bōng, Philippines, pueblo, province of Rizal; in the northwestern part of the province, near the coast of Manila Bay; five miles north of Manila. It has a large sugar reinery and a cotton factory; there is also weaving of cotton cloth and the fisheries are also important industries. It is connected with Manila by steam tramway, and carries on a considerable trade. Pop. 25,000.

*TAMBOUR-WORK*, a species of embroidery introduced into Great Britain in the 18th century, now little used. A single tambour worker usually sits at a low circular frame, over the top of which the silk, linen or muslin is stretched by means of a hoop, much in the same way as the head of a drum is tightened. A frame of different construction is used when several workers are employed on the same fabric, consisting principally of two rollers, which, when properly fixed, stretch the linen, etc., to the necessary degree of tension. As the work proceeds the finished part is wound on one roller, while a third surface is at the same time unwound from the other. The needle, which is about one-half inch in length, terminates in a small hook with the point curving inward. This is fixed in a handle of bone, ivory or wood, of the thickness of a quilt, by means of a small screw on the side. The
TAMBOURA—TAMING OF THE SHREW

worker, holding the thread on the under side of the frame, passes the needle through the muslin, etc., from the upper side, and by a continued series of loops interwoven together, succeeds in making a beautiful chain-like, with which she traverses the outline of any pattern previously sketched upon the fabric she is employed to ornament.

TAMBOURA, the name applied in Persia and Turkey to a musical instrument of the guitar type, with strings of wire struck with a plectrum. The neck is long and the body, of gourd-shape, is often beautifully ornamented.

TAMBOURINE, tám-boor-ón', a musical instrument of the drum type, much used among the Italian peasants and negro minstrels. It consists of a piece of parchment stretched over the top of a broad hoop, which is furnished with little bells. It is sounded by sliding the fingers along the parchment or by striking it with the back of the hand or with the fist, elbow, etc.

TAMBOV, tám-bóf', Russia, capital of the government of that name, on the left bank of the Tzna, at the confluence of the Studenets, 203 miles by rail southeast of Moscow. It was founded in 1626 and was first fortified, and is yet surrounded by a dilapidated rampart, and is built chiefly of wood. It has a gymnasium, military school, ecclesiastical seminary, female institute, house of correction and infirmary; is the residence of a governor, the see of a bishop and the seat of several important courts and public offices. There are breeding studs, manufactures of woollens and sailcloth, leather, soap, tallow, alum and vitriol, and a considerable trade with Moscow and Petrograd in tallow, leather, wool and provisions. Pop. 71,400. The government or province is 25,710 square miles in area and the population (1915) is 3,555,000. It is a rich agricultural region.

TAMERLANE, tám-ér-lán'. See TIMUR.

TAMIL, or TAMIR, a branch of the Dravidian stock to which the original inhabitants of India belonged. They inhabit the extreme south of India, and have remained comparatively free from admixture with the Sanskrit-speaking Indo-Europeans and other invading races of subsequent arrival. Retaining their own tongue they adopted and developed the civilization of their conquerors and are much more enlightened than other races of Dravidian stock. The Tamil language is spoken over a large section in the extreme south of India; it is spoken to a great extent in Ceylon; it is spoken also by a majority of the Indian settlers in places farther east, as Pegu, Penang, etc.; and in many parts of southern India, even where it is not the vernacular, it is spoken by the better class of Hindus. The structure of the language is very simple. It has two dialects: the higher (Shen-tamil), now used in poetry, is the more ancient of the two; the lower (Kodin-tamil) is the language of common life. The literature of the Tamil language, the earliest extant works of which are supposed to be as old as the 9th century of our era, embraces not only every branch of the knowledge of northern India. Consult Pope, 'First Lessons in Tamil' (Oxford, 7th ed., 1904). See INDIA.

TAMING OF THE SHREW

Taming of the Shrew has been immensely popular Shakespeare's and is still notably successful on the stage. There is little evidence of the date at which it was composed or Shakespeare's concern in it. It was in the 1623 folio, but a separate quarto in 1631 shows its continued time when few but the very great Shakespeare plays justified publication. This drama is a refreshment of the best pre-Shakespearean co Taming of A Shrew, printed in characters are renamed (except Kate, lines wholly rewritten, but the general plot of the is not radically altered, more in the last regard appearing in the Bianca than in that of Katharine. effort to ascribe to Shakespeare 'Taming of A Shrew' is invalidated fact that the former play below Pembroke's company and by its joines from Marlowe, legitimate is limited to discussion of the ex poet's revisionary work in preparing Taming of the Shrew. That the Petruchio scented is not beyond many critics the scene of the lovers of Bianca to an unknown reviser. No particular reason for supposition exists beyond the unwilling credit Shakespeare with work not beyond his abilities of the manuscript. This, of course, is a correct criterion: it is clear that the author is exerting power. In the case of the present logical to suppose that the entire revision done by Shakespeare, who handled plot with enthusiasm and retouched ordinate scenes with independence, quacy, but in a somewhat perfuncto. The notable Induction, with the character Sly, is not primarily Shakespeare's creation; it occurs in the earlier version indeed Sly continues on the stage throughout entire performance and offers elements like that of Revenge and Ghost in 'The Spanish Tragedy.' Shal apparently in the interests of allows him to be forgotten by the of Act I, but he has made the Induction of his own by the insertion of shire place names and allusions. On 1633 'The Taming of the Shrew' was Saint James' Palace before Charles I, queen. It is noted that the play was Two nights later it was followed by formance of Fletcher's sequel, 'The Tamel,' in which Petruchio's second with the tables. Various adaptations of the play were popular in the 17th centuries. In 1754 Garrick produced act abridgment called 'Katherine: a chio,' which for a century or more the original. The complete play by Augustin Daly in 1887 with success. John Drew played Petruchio On other Lucentio and Ada Rehan. Katharine hundred performances were given between January and 13 April.
TAMMANY HALL — TAMMANY SOCIETY

MMANY HALL. See Tammmany So-

MMANY SOCIETY, or COLUM-
ORDER, The, was founded 12 May
by William Mooney, ex-Revolutionary
(two weeks after the national govern-
ment was established), as a fraternity of
those who conceived to be independ-
ent, popular liberty and the federal union
country. It had for its objects (1) the
ity of democratic-republican institu-
tions and others of its members, "their
i and orphans, and others who may be
objects of their charity." The member-
as composed of those who were known
the Revolution as "Sons of Liberty"
Sons of Saint Tammany; societies
promote the cause of independen-
society was opposed to the Saint George,
David and Saint Andrew societies, whose
members openly proclaimed fealty to
III. After the Revolution, Alexander
on (q.v.) removed the political disabilities
for the New York Loyalists and they became
the Federalist party, and being
fought corruptly for Hamilton's
me of a Federal President and Senate,
office for life, who should appoint the
governments and dominate Congress.
3. These Loyalist Tories were elevated to
immediately on their enfanchasement.
ragged the "Liberty Boys" who fought
soldiers, and suffered repeated be-
these same Loyalists whose plots were
against the patriots. Many of these Tory
aces were successful and sent numbers
into the charnel prison ships to meet
others failed, as when the Tory mayor
York, Mathews, plotted to kidnap
rgate and assassinate his staff. The
broad by these and kindred infamies was
fire by the disfranchisement of
onary soldiers whose means and prop-
erie meagre. In 1777 the constitutions
and the constitution of New York State
to the value of 100 pounds, free of
its. This gave full political power to
Loyalist Tories who monopolized trade
ning privileges, while it disqualified the
those who fought in the patriot army
and property. The Cincinnati (q.v.)
to the existence of bitterness and hatred,
and others pointed out its menace to
ries of the people and its monophasal
found an order of hereditary nobles,
nitarianism as a basis. The Tammany
as a crowning protest to
portentous happenings and to discredit
Hamilton's prophecy that the democ-
republican scheme of government was
led to disastrous failure.

y History.—The Tammany Society was
into 13 tribes corresponding to the 13
States. The Society adopted Indian
and ceremonial and the forms and usages
adapted to the fullest extent practical.
igwam was the term applied to the So-
place of meeting. Indian symbols and
mottos were used to designate the 13 tribes,
as follows:
The Eagle Tribe, New York State.
The Otter Tribe, New Hampshire.
The Panther Tribe, Massachusetts.
The Beaver Tribe, Rhode Island.
The Bear Tribe, Connecticut.
The Tortoise Tribe, New Jersey.
The Tiger Tribe, Delaware.
The Kattinsunk Tribe, New Jersey.
The Fox Tribe, Maryland.
The Deer Tribe, Virginia.
The Buffalo Tribe, North Carolina.
The Raccoon Tribe, South Carolina.
The Wolf Tribe Georgia.

The 13 sachems (or trustees) annually
elected a grand sachem or president. The
kitchi agnew, or great grand sachem, was
an honorary office conferred upon the following
Presidents of the United States: Washington,
John Adams, Jefferson, Madison, Monroe, John
Quincy Adams and Jackson. The office was
abolished after General Jackson's incumbency.
The Sagamore was the master of ceremonies
and the Wiskinskie the sergeant-at-arms.
According to the true Indian fashion the year
was divided into seasons and these subdivided
into moons. The era began with the discovery
of America by Columbus and included the year
of the Declaration of Independence and
of the founding of the Society. (New York City, 3
Dec. 1803, is written by the Society thus:
Manhattan Season of Snows, 12th moon, year of
discovery 411th, of Independence 127th and of
Institution 114th). The Society motto is "Freedom
our Rock." The following toasts at the
4 July 1789 banquet illustrate the Society's
sentiments from its formation. Thirteen cannon
shots followed each toast. These are the two
first toasts: (1) "May honor, virtue and patri-
that character ever be the distinguished
Sons of Saint Tammany." (2) "The
head men and chiefs of the Grand Council of
the Thirteen United Fires — may they
convince our foes not only of their courage to lift,
prudence to direct, and clemency to withhold the
hatchet, but of their power to inflict it in their
country's cause."

Achievements.—The national government
repeatedly failed to conclude a treaty of peace
with the warlike Creek Indians whom the Fed-
eral government was anxious to placate. The
Tammany Society undertook the conciliation.
The Celtic half-breed chief McGillivray, who
led the Creek tribe of Indians, with 28 of his
chiefs and warriors were brought to New York
by Tammany and given a banquet 2 Aug. 1790.
The Tammany braves were in full Indian
costume when they escorted McGillivray and his
warriors to President Washington. The treaty
was signed 13 Aug. 1790. The Society in June
1790 founded a museum for "the preservation,
collection, and study of Indian relics, etc." In
1791 the Society, under the direction of John
Pintard, its first sachem, founded many edu-
cational and progressive institutions which later
developed great efficiency under the Society's
fostering care. Two of these institutions have
since merited national recognition, namely, New
York Historical Society (q.v.) and the Acad-
emy of Design (q.v.). In 1793, when France in
desperation struggled to overthrow feudal op-
pression, the Tammany Society's sympathy and
moral support was prompt, enthusiastic and
enduring. Sentiments and sympathies of politi-
cal and other associations were usually expressed
by toasts at a banquet specially held for that purpose. Until about 1840 these "public dinners" were the chief means of announcing the policies, boroughs and candidates of political and social bodies. On 12 May 1793 the Tammany Society, at its annual dinner, gave the toast, "Success to the Armies of France, and wisdom, concord, and firmness to the Convention." This was followed by roasting, by roasting for many minutes. The society suffered a flood of vituperation, abuse and threats of grave harm from the Tories and Federalists. In 1800 the society bought real estate collectively to comply with the property qualifications imposed on the voter. On 13 April 1808 the society marched in a body to Wallabout ("Wallabout") Bay, where the foundation stones were laid by them of the receiving vault, for the bones of 11,000 patriots, victims of England's brutality. The society collected 11 hogheads of bones along the beach of Wallabout Bay of those who died of hunger, disease and cold in the awful English prison ships. Tammany interred these bones in a tomb near the present navy yard with imposing military honors. In 1809 the Tammany Society loudly called for war with England, pledging their lives, fortunes and sacred honor in support of the government for the waged of that just and necessary war. At every stage of the conflict the Society gave full and loyal support. Tammany Hall in Nassau street became the headquarters of the war party where they hoisted the flag to proclaim each victory and celebrated the success of the American forces. Tammany also gave a fighting force to the nation, which developed later three able generals and a colonel. In August 1814 about 1,200 members of Tammany Hall went in a body to Brooklyn and erected earthworks and other defenses. On 29 June 1814 members of the Tammany Society mobbed a large Federalist meeting gathered to celebrate the return of the Bourbon dynasty to the throne of France. In 1817 the Society with high patriotic speeches and ceremonial made into the inaugural of General Hall Farrar in Saint Paul's churchyard. On 23 Feb. 1819 Tammany gave a banquet in honor of Gen. Andrew Jackson at which they launched a boom in his behalf for the Presidency.

Manhood Suffrage.—From the moment of its foundation in 1789, the Tammany Society fought for manhood suffrage and against "imprisonment for debt." On 1 Dec. 1820 a Tammany Hall mass meeting resolved: "That the distinction of the electoral rights; the mode of appointment to office and the union of the judiciary and legislative functions were objectionable and highly pernicious." The meeting urged the legislature to pass the reform measure and advocated and when the legislature overwhelmingly advocated the extension of the suffrage. Tammany celebrated the victory for reform 14 June 1821, at Tammany Hall with democratic jubilation. The sentiment dominant at this gathering is tersely expressed by one of the resolutions: "We will not be ruled by a man without an estate than by an estate without a man."

On 4 March 1822 a banquet was given at Tammany Hall for the purpose of expressing their thanks to the many who rallied to the right of suffrage and the abolition of those cumbersome relics of old centralizing methods, the Council of Appointment and the Corporation Acts. The function of the former expressed in its title; that of the latter to give final approval or disapprove legislation. The "Toasts" at this banquet appropriately express the Tammany sentiments of the participants. Here are two: "The right of suffrage—corruption in office must be fought, most to hate for a few years to a few. This was another: "The noble and rising politician—may integrity guide him—studying the public not popularity." The extension of the right of suffrage greatly increased the voting of Tammany and augmented its political strength. In 1820 manhood suffrage in full a fact; Tammany's political power had increased, in this year Tammany succeeded in abolishing the last vestige of property qualification to the right of suffrage by an overwhelmingly large popular vote. In 1826-27 the Tammany Hall forced the fever for the five-year limit on the acquisition of citizenship. In 1827 many delegations visited General Jackson in Orleans to press the Tammany case for the famous battle in which he triumphed, and to urge his candidacy for the presidency in the coming year. Martin Van Buren, who was a member of the Tammany Hall, visited New York later in the year to realize the sentiment of the Society for the ticket. To offset this sentiment, the Tammany ticket, and the tall vote of Tammany, the "Native American" was formed, whose battle cry was "Liberty, property and the rights of the people of the country." In 1828 Tammany carried General Jackson nearly 6,000,000 majority ticket of over 25,000. This was the national election held wherein the State of New York chose presidential electors by popular vote.

Mid-Century History.—On 26 Nov. Tammany Hall held high festival in honor of the French Revolution. President Jefferson, though in feeble health, reviewed the Tercentennial parade and later presided at the banquet given Tammany Hall at Fairlawn in Saint Paul's churchyard. On 23 Feb. 1819 Tammany gave a banquet in honor of Gen. Andrew Jackson at which they launched a boom in his behalf for the Presidency.

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to pass as a reform measure an act per-
New York City to elect its mayor. In
Tammany Hall for the first time in United
history elected a mayor by popular vote.
John's candidate was Cornelius W. Lau-
The United States Bank and the com-
monwealth's power of the period bent every
to defeat Laurence. All the newspapers
blamed, and ridiculed the citizens with
atory editorials predicting "Universal
. . . general destitution, . . . trade paralysis".
scaring panic. Agents of the banks
hugs and bred riots. Serious disorder-
scenies of violence preceded the elec-
very form of coercion was employed on
ness element and actual trade suspension
fully produced. Yet, despite all these
and real terrors and their influence
mid and greedy, Tammany elected her
in 1861, Grand Sachem William
ved to take the front a regiment com-
members of Tammany Hall, which had
its threat suppressed by the army.
This regiment, the 42d New York,
t, distinguished itself for valor in 36
and engagements. In 1864 Tammany
ined General McClellan's name at the Chi-
ization districts and subordinate state
party. General McClellan
in the ensuing election, from Tam-
hforts, a majority of over 37,600 in a
ite of about 110,000. In 1870 Tweed,
gained an ascendancy in Tammany Hall,
ed the organization to many extra-
penditures, thus bringing much scandal
igwamp. He was forced to retire
leadership and was driven out of the
prey to ruin and disgrace. Since that
ammany has ceased to stand for high
and has become emblematic of boss
policies for "what there is in it."
History.—In 1872 the reform of the
ation was undertaken by a group of
under the guidance of Samuel J.
Tammany came to the front again
Kelly as its leader. It became a
ity, State and national politics.
Mr. Kelly, Tammany largely regained
ience and respect of the Democracy.
, in 1886, Tammany was gov-
y a committee consisting of Richard
James J. Martin, Hugh J. Grant and
F. Gilroy. This government even-
the absolute leadership of Richard
. Under the influence of Mr. Croker,
, 1888 won a series of brilliant po-
ities, establishing democracy firmly
ity and State. It was due to Mr.
ful management that all of the
1 Democratic organizations in opposi-
Tammany Hall were put out of exist-
Tammany left the sole representative
ocracy in this, the greatest city in the
. In 1900, after the defeat of
ocracy in the country at large, Mr.
ceased to take an active interest in
by a hard fought municipal defeat in
1892, and the wis Nixon, a protégé of Mr. Croker's,
ined in command. Mr. Nixon's training
is for the navy. His knowledge of poli-
tics was purely academic, and his leadership
was naturally very brief. The organization
then drifted along under the leadership of a
committee consisting of Daniel F. McMahol
Louis F. Haffen and Charles F. Murphy. In
1903 Mr. Murphy assumed the leadership
the vote of the executive committee. Mayor
George B. McClellan and the entire Tammany
ticket were elected in November 1903.
He was re-elected, and in 1910 William J.
Gaynor was elected by Tammany. While Mr.
Gaynor was markedly independent, yet Tam-
many held its grip on most of New York's
political activities. In 1913 the fusion can-
didate, John Purroy Mitchell, beat the Tammany
forces, and there was a partial return to Re-
publican rule. However, notwithstanding
Mitchell's acknowledged ability and popularity,
Tammany beat him in 1917, with an almost un-
known candidate, John F. Hylan. Tammany
maintains in Manhattan probably the strongest
and best organized political machine in the
world. While there are Democratic organiza-
tions and leaders in the outlying boroughs,
they are known to be ineffective.
Tammany leaders — the very name of Democratic organiza-
ion is lost. Permanent headquarters and
leaders exist in each of the 23 assembly dis-
tricts, to handle the details like a
great army. They are in business all
year around and every day in the
aiming to maintain their hold in all the political offices
and all the expenditure of public moneys that
they possibly can. The fact that they have
been able to place many judges on the bench
as well as to control most of the executive of-
ices has at times been the subject of great
scandal. Yet membership in the organization
includes very many men of high character and
patriotism, and their influence at times is
apparent.
Tammany for many years has catered to
and largely held the votes of the poorer classes
— charity has been dispensed widely from the
district offices; bureaus are maintained to give
work to those who can be depended upon to
vote with the organization; excursions, parties
and dances are given freely; those who have a
bad habit of getting into jail for small offenses
are systematically bailed. Notwithstanding
that, members and followers have been charged
time and again with catering to vice, even dis-
cussing it and trafficking in it; with dishonesty
and wastefulness of public funds; with placing
and keeping incompetents in office, and the en-
tire list of political mistakes, weaknesses and
crimes, yet after every exposure and temporary
reform, the same old Tammany comes back to
power and dominates the politics of the world's
largest city. Consult Breen, 'Thirty Years of
New York Politics' (1899); Poore, 'Richard
Croker' (1901); Riordon, 'Plunkett of Tam-
many Hall' (1905); Forrest, J. W., 'Tam-
nany's Treason' (Albany 1913).

Tammerfors, täm'mér-fôrs (Finnish, TAMPERE), Finland, a town in the government of
Tavastehus, about 80 miles northeast of
Abo, on the railway from the Gulf of Finland
to the Gulf of Bothnia. It is the third largest
town in Finland, and the principal manufactur-
ing centre. Its industries include cotton and
linen spinning and weaving, and the manufac-

ture of paper, iron and steel mills, locomotive works and shipyards. Pop. 45,213.

TAMMUZ, täm′ūz, a Babylonian deity, worshiped by Jews who drifted into idolatry, and mentioned in Scripture, in Ezekiel viii., 14: "Then he brought me to the door of the gate of the Lord's house which was toward the north, and behold, there sat women weeping for Tammuz." According to Sayce (in Hastings' Dictionary of the Bible) Tammuz was originally the sun-god, and was a Babylonian deity whose worship was early imported into the West, the name being in Sumerian Dumuzi, "the son of life." In Canaan Tammuz was addressed as Adonai, "my lord," whence the Greek Adonis; and as Tammuz was originally associated with the Babylonian goddess Istar (Asarte), so Adonis was associated with Aphrodite. The Vulgate agrees with this explanation by its rendering of Tammuz as Adonis. This worship was much practised among the Phenicians, and was celebrated chiefly at the Phenician town of Byblus. The ceremonial was prolonged through different scenes. Adonis was supposed to have been killed by a boar; search was made for him, a wooden image being provided to represent Adonis, and on his being found, wild and licentious orgies began, and the burial of the idol terminated the first portion of the pageant. The river of Adonis, or Nahr Ibrahim, at the season of the year at which this worship took place, becomes discolored from the heavy rains on Lebanon, and in the popular superstition the stream was stained by the blood of Adonis.

The resurrection of Adonis next followed in the ritual, and was celebrated with fratricidal rejoicings. This idolatry appears to have been originally symbolic, connected with the sun's decline in the winter and his returning strength in summer, or with the death of nature and its revival in spring. The festival seems to have been held at the summer solstice. Movers and Hitzig place it at the autumnal equinox; but Tannuz is with the Jews the name of the fourth or midsummer month. Jerome also asserts that the anniversary of the death and resurrection of the fabulous Adonis was celebrated in the month of June. It was, however, in the sixth month that Ezekiel's vision happened. The period of celebration might perhaps vary, or the time of the prophet's vision might not be coincident with the actual celebration of the festival. The worship of Adonis was suppressed by Constantine. Consult Langdon, S., "Tammuz and Ishtar" (Oxford 1914).

TAMPA, Fla., city, port of entry, county-seat of Hillsborough County, at the mouth of Hillsborough River at its entrance to Tampa Bay, and on the Atlantic Coast Line and Seaboard Line railroads, being the Gulf terminus of both, about 29 miles from the Gulf of Mexico. It has a harbor, the best on the western coast of Florida, and it has regular steamer connection with all the large Gulf ports, large ports of the West Indies and with New York and a number of other Atlantic ports. In the vicinity are large mines of phosphate. Lumber and naval stores are largely produced and shipped.

Manufacturing.—The chief manufacturing industry of Tampa is connected with tobacco products. In 1914 the number of factories was over 200 (three-fourths of them being cigar factories), the capital invested $9,500,000, and the value of the product for the year $65,000,000. The wages paid to workmen are more than $5,000,000 annually. The tobacco used in the factories is nearly all imported from Havana, Cuba. The manufacturing of tobacco is Tampa is largely done by Cubans. The Sumatra "wrapper leaf" grown in Florida is said to be superior in quality to that grown in Sumatra, and is used to some extent.

Commerce.—The amount of tobacco leaf imported into the port of Tampa from Havana has for several years exceeded that of any other United States port except New York. The internal revenue paid by the city exceeds $1,000,000 annually, and the custom collections for the district are about $9,000,000. Phosphate comes next after tobacco, and over $3,000,000 is sometimes shipped abroad in a single year. The quantity of fruits and vegetables which are being shipped to Northern markets is increasing.

Buildings and Municipal Improvements.—Since 1886, when Tampa was made a port of entry, it has grown rapidly. To accommodate its late number of winter guests, many large and beautiful hotels have been erected. Other public buildings are the custom-house, the churches, the schools, the banks and many of the business blocks.

The electric car lines connect the suburban sections with the different parts of the city. The water supply comes from springs; the daily use is 7,000,000 gallons. The pumping capacity of works is 10,000,000 gallons.

Churches, Schools, Etc.—There are 8 church buildings. There are 12 public school buildings, including the Hillsborough County High School, established in 1886. Another high school is in charge of the Sisters of the Holy Name, who conduct three parish schools in Tampa and one in each of the nearby suburbs, West Tampa and Port Tampa. There is a college for boys, under the management of the Society of Jesus, and five private schools. There are three daily and five weekly newspapers. The six banks have a combined capital of $1,000,000, and deposits amounting to over $6,000,000.

Government.—The government is vested in a mayor and a city council, elected by the people for terms of two years. The council has 11 members, three being elected at large. There are police, sanitary and public works departments, including a board of health with ample powers to protect the city's interests.

History.—Tampa is the historical landing place of Narvaez and De Soto, of ill-fated early Spanish expeditions. Its first settlement began with the establishment of the United States military post of Fort Brooke, during the wars with the Seminole Indians. It was the seat of small shipbuilding and salt works during the Civil War, and was captured by Federal gunboats. Its recent rapid growth dates from the coming of railroads and factories in 1886. Pop. (1910) 37,782; (1919) 52,000.

TAMPA, a bay on the west coast of Florida, an inlet of the Gulf of Mexico. The northern part is divided into an eastern arm, Hillsboro Bay, and a western arm, Old Tampa
American Scarlet Tanager (Pyrrhula rubra), with a female (below) and immature males (above).
American Scarlet Tanager (Pyrrhula rubra), with a female (below) and immature males (above).
harbor is protected by a line of keys
arrows against the west winds. A
nd extending south almost closes the
or. The bay is about 35 miles long
5 to 15 miles wide. At the entrance.
Key, lat. 27° 36' N., long. 82° 45' 15".
ighthouse is nearly 90 feet in height.
landing place of the Spanish ex-
Soto and De Narvaez. On its shore.
States government maintained Fort
many years previous to the Civil
ing the Spanish-American War this
ie principal point of embarkation for
ites troops to Cuba.

AN. A poisonous tick found in
other parts of southern Africa.
the size of a pea and when filled
is dark blue in color. It usually
dits between the toes or fingernails
and possesses a tooth-like structure
which gradually
limbs till it reaches the abdomen
or any other part.

ICO, täm-pekö, Mexico, a town in
of Tamaulipas, situated in the southern
the state at the mouth of the

It is an old Aztec city, built in
healthful locality, surrounded by
marshes. The streets are broad,
with large market places, and
several fine buildings. The harbor
supplied by jetties and a breakwater,
prives Vera Cruz as a commercial
development during recent years is
to the finding of petroleum near
the terminus of two railroads, and
railway outlet for all the Northeastern
steamship lines of the vicinity mar-
. The exports are petroleum, min-
raxing products, wood, honey, wool
to the total of nearly $100,000,000.
The imports are of about one-half
being mostly manufactured articles
United States. Pop. about 36,000.

ICO FIBRE. See ISTLE.

VORTH, Australia, an inland town
south Wales, in the northeastern part
on the railroad from Sydney to
It is the centre of an agricultural
district. Pop. about 7,750.

VORTH, England, a borough of
ire, on the Tame River, 110 miles
London; the site of interesting old
ung from the 8th century. Pop. 7,500.

, tä’na, British East Africa, a river
slope of Mount Kenia, and flow-
ast into the Indian Ocean. It is
improved draught vessels about 350
ameye, just below the Hargazo Falls.

See TREE-SHREW.

, Lake. See DEMBIA.

GER, a family of perching birds
, allied to the finches. They are
ed by the bill being of triangular
basis and arched toward its tip. The
dible may exhibit a notched appear-
ance, are painted in moderate
feet short and slender. The hinder
ning and elongated, all the digits being
ith strong curved claws. These birds
found in the tropical parts of Amer-
clude several genera and many species,
all of brilliant coloration and usually capable of
fine singing. One of the best known is the
organist tanager (Euphonia muscina) of the West
Indies, so named from the pleasing and varied
ature of the song. The Antilles possess sev-
peculiar species. Three or four species of
the genus Pyranga are regularly
in United States in summer, one, the scarlet
tanager, or black-winged fire-tite (P. rubra),
being familiar at that season throughout all the
Northern and Eastern States and southern Can-
da. It is of less size than the robin, and a bird
of the woods and orchards rather than of open
lands, and almost never seen upon the ground.
The male is everywhere rich scarlet except his
wings and tail which are pure black. This full
plumage is not acquired, however, until the
fourth year, the young males being dull yellow,
more or less reddened according to age; while
the females are always clothed in an inconspic-
ous dress of mottled green. The song of the
male is loud, vigorous and merry, and is heard
later in the summer than the call notes of the
birds. The nest is a rather rude structure placed
in a tree, and containing greenish, brown-spotted
eggs. In the Southern States another species,
the summer redbird (P. astica) is of more pink-
sh and glowing hue than the scarlet tanager,
and lacks the black on wings and tail; it has a
Western variety (Cooperi). The males of
other Western species, the Louisiana tanager
(P. ludovicianus) are yellow and black, with the
head red; and a fourth darker species (P.
kerstingi) is mainly Mexican. Consult Ridgway,
‘Birds of North and Middle America,’ Part II,
(Washington 1902), and standard books on
American birds.

TANAGRA, tä’na-gra, Greece, an ancient
town of Boeotia, on the left bank of the Asopos,
15 miles east of Thebes, the scene of a battle
in 455 B.C., between the Athenians and the Spar-
tans, in which the latter were victorious. Tan-
gra, now called Gremada, is a scene of ruins.
Excavations since 1873 have brought many in-
teresting objects to light, especially the beautiful
vases of terra cotta draped female figures from
six to nine inches in height, known as Tanagra
figures.

TANANARIVO, tä-nä-nä-rë’vō. Capital
of the island of Madagascar. Its most promi-
ent building is the royal palace which is
located at the top of a hill. The palace has no
chapel but has a few industries and many
new buildings, among which are two cathedrals,
mosque, several colleges and hospitals and
a number of churches. Pop. about 95,000.

TANARO, tä-nä’ro, a river of Italy known
anciently as Tanarus. It rises in the Ligurian
Alps, in northwestern Italy; flows northeast
past Asti and Alessandria, and runs into the
Po 10 miles northeast of Alessandria; length
125 miles.

TANAUAN, tä-nä’wän, Philippines, (1)
Pueblo, province of Batangas, Luzon, in
the northeastern part of the province, 24
miles north of Batangas. It is on the main road
to Manila, and was wiped out by the erup-
tion of Taal in 1754, but rebuilt. It is the
centre of sugar and tobacco raising and fruit
growing country, and has large markets. There
are good schools. Pop., 20,040. (2) Pueblo
province of Leyte, in the northeastern coast, on
TANCHÉL—TANEY

San Pedro and San Pablo Bay, nine miles south of Tacloban. It is on the coast road. Pop. 18,510.

TANCHÉL, or TANQUELIN, a fanatic who arose in the Netherlands about 1115, who proclaimed himself Son of God, and had many followers. He was killed at Antwerp in 1125 and those who believed in him, known as Tanchélians, or Tanquelinians, were converted back to the Roman Catholic faith.

TANCRED, tâŋk'red, soldier and Crusader: b. about 1068; d. 5 Dec. 1112. His father was a Sicilian or Italian marquis named Odo or Ottobonus; his mother the sister of the celebrated Norman, Robert Guiscard, whose eldest son, Bohemond, was the friend and brother-in-arms of Tancrèd. (See Guiscarr.) In 1096 the two heroes embarked for Epirus, and thence marched to Macedonia. At the siege of Nicea (1097) Tancrèd first appears among the heroes who directed the course of events, and he was to play a conspicuous part in the battle of Doryleum (July 1097). He now advanced, with Godfrey's brother Baldwin, over the Taurus toward Jerusalem. Tancrèd first penetrated through the passes of the mountains, and obtained possession of Tarsus by capitulation. The perfidious conduct of Baldwin caused a quarrel between him and Tancrèd, but it terminated in the reconciliation of the chiefs, who now joined the main army which was then marching upon Antioch. On the march to Jerusalem, Tancher had command of the advance guard, and he was the first to storm the walls of the town. During the scenes of horror which attended the capture of Jerusalem (July 1099) he conducted himself with humanity. The Sultan of Egypt advanced to attempt the recovery of Jerusalem, but was totally defeated by Godfrey of Bouillon and Tancrèd before Ascalon (12 August). Tancrèd captured Tiberias, besieged Jaffa and, after the death of Godfrey, endeavored to effect the election of Bohemond as king of Jerusalem; but the unworthy Baldwin obtained the throne. Tancher subsequently conducted the defense of Antioch, and after Bohemond's death in 1111 of disease, the kingdom. He is represented by Tasso in the Jerusalem Delivered as a brilliant and blameless hero. He is also celebrated in Rossini's opera 'Tancrèd' (1813). Consult Guizot, 'Collection des Memoires-Gesta Tancrèd'; Delbarre, 'Histoire de Tancrède' (1822).

TANDOLANOS, tân-dô'lán-os, a wild Philippine tribe of Malay origin living on the west coast of Palawan, between Punta Diente and Punta Tuñuran.

TANDUBATO, tân-doo-bá-tó, Philippines, one of the smaller islands of the Tawi-Tawi group, of the Sulu Archipelago, lying off the northwest coast of the island of Tawi-Tawi; long, north and south, six miles; greatest width, five miles. The island is mountainous, Tandubato peak being the highest point. See Tawi-Tawi.

TANDY, James Napper, Irish patriot: b. 1741; d. Bordeaux, France, 1803. As a Protestant leader of the popular movement he took a leading part in American politics, free trade ascension and volunteering affairs, and was elected the first secretary to the United Irishmen of Dublin. In 1792 he went to the solicitor-general Toler, and was confined to prison till the collapse of the House of Commons. As the vicar offered a reward for his arrest, the formal action for illegality against privy-councillors, which was the final hearing. For distributing in a seditious pamphlet, he was at 12 Feb. 1793, when the government had met the Defenders and with the view of effecting a them and the United States, but crossed where he was raised to the rank of division in the French army. He fated invasion of Ireland, and landing at Rutland Island 16 Sept., escaped to Hamburg, the senate handed him over to the English on 12 Feb. 1800, he was put on trial and acquitted. He was again put up on the reasonable landing on. This time he was sentenced to new motives of policy, was permitted way to France, where he spent days. He was the hero of the song, 'The Wearing of the Green'.

TANJEPF, Serge Ivanovitch, composer: b. 1856; d. Petrograd, 20 1. He was son of a Russian gow and, while quite young, was study, forte at Moscow Conservatory. He was next sent to the public school it was decided to continue him under Nicholas Rubinstein. He under Hubert, leaving the conservatory with the award of the first gold played in Paris 1877-78, then perfo the Baltic provinces, next returni where he was appointed prof... articulation, succeeding Tchaikows... Rubinstein's death he became piano forte but displayed his ta... before the public. He composed... ogy in eight acts (1895); 'John do' a cantata (1884), many choruses... phonies and quartets. He arra piano works of Tchaikowsky, Arinsky and others.

TANEY, ta-nil Roger Brooke, jurist: b. Calvert County, Md., 1777; d. Washington, D. C., 12 Oct. 1 was descended from a leading Re family, was graduated in 1795 from College, read law in Annapolis, 1 in 1799 and was immediately in the house of delegates as a Federalist in 1801 and again in 1803, he returned tice of law. He was married 1 Phebe Charlotte Key, a Protesta Francis Scott Key. Though a... the government during 1812 and was an unsuccessful in Congress. In 1816 he was elect... from 1815 to 1831 as one of lead... an important cases that came before the States Supreme Court. After the his party, he became a Democrat. It was attorney-general of Maryland; an was appointed Attorney-General of th States and was the trusted adviser of
ROGER BROOKE TANEY

Chief Justice of the United States Supreme Court, 1836-1864
TANGANYIKA — TANGENT

Bank controversy the Secretary of
y refusing to remove the govern-
same, the President of the United States Banks, so
had advised the removal, was trans-
s 833) to the office of Secretary of the

He then removed the deposits and
as fiercely criticised as being a "tool"
the Senate in 1834 refusing to con-

nomination, the Senate turned its back on a

Cabinet officer. In 1835 Jackson
him for associate justice of the Su-
sur, but again the Senate refused to

In 1836 the personnel of the Senate an-
ged, Taney was nominated and con-

chief justice to succeed John Marshall,
without strong opposition from Henry
others. Taney at once showed tenen-
tu ns solid strict construction and reversed f
Marshall's decisions. This angered the jus-
tices, some of whom threatened to

Taney was a strict constructionist
a the State's rights lawyer and judge.

of Prigg v. Pennsylvania the chief
the first time declared a State law
states' rights of the marine mussels, which are national
laws. In 1850, a similar law of Wis-

as declared invalid. These decisions
preme Court called forth States rights
is from Northern legislatures. Taney's
decision was made in the Dred
The only point really decided was
Scott was a slave, but the opinion of
written by Taney also declared: (1)
ones had not been regarded as citizens
of the Constitution and hence
become citizens of the United States
a standing in Federal courts; (2)
Missouri Compromise was unconstitu-
ti Congress was bound to protect
and the Constitution having recog-
izes as property. Congress was bound

slavery in the Territories. During
War the Supreme Court ceased to

ence. Taney in the Merryman case
cned the power of the President to
he writ of habeas corpus, and during
three years opposed with no effect the
the methods of the administration. As

Taney never avoided the unpopular
1811 he made himself disliked by de-
. James Wilkinson. In 1819 he de-
Northern Methodist minister indicted
slaves to insurrection. During the
his case he said: "A hard necessity
is to endure the evil of slavery for a
while it continues it is a blot on our
charter. He emasculated his slaves,
for further reference to the system of
ist failed to carry it before the Court
which it had lacked under

Weak sight and bad health made

hearing, in spite of wretched health.

he was tall and thin, with an ap-
mong the most pious and peaceful of
state, and regarded the Patronage, of

Tanganyika, tā-gān-yē'kā, central
Africa, a large lake on the boundary between
the Congo Free State and what was German
East Africa, touching its southern extrem-

ity on British Rhodesia. It lies in the Great
Rift Valley, is over 400 miles long, 30 miles
wide, and extends in a south-southeast direction
from lat. 3° 20' to 8° 44' S. The shores are
somewhat irregular but there are few islands or
reefs. The lake is hemmed in on both sides by
lofty, precipitous mountains, through a break
in which the water is discharged by the Lukuga
into the Congo, when the water is high, but in
low years there is little or no discharge.

Nearly all the surface is navigable, and sound-
ings at some points have been made to

feet. The sudden storms of the locality are,
however, a real danger to navigation. The
water is slightly brackish and swarms with
fish, crocodiles and hippopotami and some
marine mollusks, which suggests former
connection with the ocean. English and
German steamers ply on the lake; Ujiji is the
principal trading station on the shores.
The lake was discovered by Speke and Burton in
1858, and later explored by Livingstone and
Stanley. It was mapped by E. C. Hore about
1880, and the outline considerably corrected by
later explorers. The first steamship was the

Good News, launched by the London Missionary
Society in 1884, and a half dozen now ply the
waters. Consult Burton and Speke, Living-
stone and Stanley's works: Hore, E. C., 'Lake
Tanganyika' (London 1892); Moore, J. E. S.,
'The Tanganyika Problem' (London 1903);
files of the Geographical Journal, and 'Pro-
cedings of the Zoological Society' (London
1906).

TANGENT, a straight line of indefinite
length, which touches but does not cut a curve;
also the length of a straight line which touches
a curve measured from the point of tangency
to the point where it meets a diameter of the curve;
one of the trigonometrical functions. The tan-
gent to a curve is the limiting position of a
secant. Suppose a straight line as cutting a
curve in two points near to one another, and
then suppose the line to move so that the points
approach each other; at the instant when the
points coincide the line is a tangent to the
curve. Let $A B$ be any arc
less than 90°, draw $AH$ touching
the arc at $A$; from the cen-
tre $C$ draw $CBH$, cutting $AH$
in $H$; the length $AH$ is the
tangent of the arc $A B$. It is
now considered best to make a
distinction between the tangent
of an arc and the tangent of an
angle. An arc is a curved line
certain length; an angle is
not measured by the length of
arc, for the measure of a certain angle is so
many degrees, whatever may be the length in

D

Tangent.
senting the length of the other side. Consider the triangle $u$, the tangent of the angle $\alpha$.

$\tan \alpha = \frac{1}{\cos \alpha}$; this fraction is the same whatever $u$ is.

the lengths of $u$ and $\alpha$. (See Trigonometry.) A plane is said to be tangent to a curved surface when three points of the plane coincide with three points very close together on the surface. A list of the properties involving tangents may be obtained from works on analytical geometry.

TANGHIN, a poison yielded by the seeds of Cerbera (Tanghinia) venenifera, a tree of Madagascar, which is itself called tanghin. The oblong elliptic smooth leaves are crowded at the ends of the branches, whence spring also cymes of small flowers. The smooth, roundish, yellow fruits contain a fibrous nut, enclosing a poisonous kernel about the size of an almond. This kernel was used by the natives of Madagascar, to detect witchcraft, or to determine whether or not an accused person were innocent. The seed was pounded and administered to him; if it acted as an emetic, his innocence was established, and no great harm ensued; if he retained the poison he died quickly—a sufficient evidence of his guilt. It has been said, however, that the issue was arranged beforehand, and a strong emetic was given to the suspected criminal not doomed to death.

TANGIER, tân'-jër', or TANJA, tân'jâ, Morocco, a seaport town on the Atlantic Ocean, near the western entrance of the Strait of Gibraltar, southeast of Cape Spartel. It stands on a height near a spacious bay, and presents a striking appearance when approached from the sea. It is surrounded by walls, and is defended by a castle and several forts; but consists mostly of wretched houses, huddled together in narrow, dirty lanes. The residences of the European consuls, and those of a few wealthy merchants are exceptions, and the gradual introduction of good hotels, European stores, electric lighting, etc., is effecting a notable change. The principal building is the castle commanding the height, but in a very dilapidated state. The total value of the imports, chiefly from Great Britain, France (and before the war Austria and Germany), in 1914 was $4,200,000; of the exports, $2,825,000, chiefly to Spain, Great Britain, Egypt, France and the United States. The principal articles of export are eggs, oxen, slippers, wax, woolens, goat skins and carpets. The internal traffic is chiefly with Tetuan and Fez. In the time of the Roman Empire, Tangier, under the name of Timgi, was the capital of western Mauretania. It afterward came into the possession of the Vandals, Byzantines and Arabs in succession. From the last it was taken by the Portuguese in 1471, and in 1602 was annexed to the English Crown as part of the dowry of the Infanta of Portugal. In 1648 it was abandoned by the English on account of the expense necessary to keep it up. It was bombarded by the Spaniards in 1706, and by the English in 1807. Pop. estimated at 40,000 in 1911, including over 9,000 Jews, and about 10,000 Europeans.

TANGIER, a sandy island of Virginia about five miles long, in Chesapeake Bay, southeast of the mouth of the Potomac. Tangier Sound, which washes the north is noted for its large oyster beds.

TANGLEWOOD TALES, a volu
ejuvenile stories published by Hawthorne. The narrations are based on Greek and are told by a certain Fustas B., supposed narrator of the stories in H., "Wonder Book."

TANGUY, tân'ghâ, Cyprien, (clergyman and genealogist; b. O. d. 1902. He was graduated (1839) at a Seminary and ordained to the Catholic in 1843. In 1860 he founded Rimous

le and the Notre Dame Convent in Germain. He was appointed (1867) a Canadian government to make results to Canada, and in 1867, to search Europe's archives for Canadian data. He was one of the earliest Fellows of the Royal Society of Canada, He is "Dictionnaire généalogique, des famili

nadiennes" (1871-90, 7 vols.); "Le répertoire clerge canadien par ordre chronologique" (1893, 2d ed.).

TANHAY, tân-hâ, town, province cros gros oriental, on the Tanhay River, above miles inland from its mouth, 15 miles, no Dumatguete. It is near the south entra Tañon Strait, and on the coast road. 12,410.

TANIS, tân'is (Hebrew, Zoan), an Egyptian city, south of the Delta, before founding of Alexandria, the chief city of Egypt, capital of the Nekhor about 2100 B.C., and of Rameses II and neptath of the 19th dynasty, who built great temple to Set, the god of war. It is a great city for probably 2,000 years, but its prosperity was destroyed by the silting up of old Tanitic mouth of the Nile, which was from its original mouth, and it was destroyed for reb 174 A.D. The filling up of the delta has in its being left far inland, so there was no inducement to rebuild it. Numerous monuments have been made of the ruins a obelisks in all were uncovered, and many sacred temples and much statuary. It has been identified with Zoan, mentioned in her. xiii, 22, and also with Rameses. The near the fishing village on San el Hagar the south shore of the Lake of Ma'analae explored first by Mariette in 1850, and by Flinders Petrie (q.v.). Con. "Tanis" (1885); Breasted, J. H., "Anci
tords de Egypt" (1907).

TANJORE, tân-joir', India, capital of the same name, in Madras, about 45 miles from the sea, miles southwest of Madras. It is a station on the Great Southern Railway. The fortified town, about four miles in contains the palace of the rajah, paga-das and irregular streets. Outsi are other quarters, an English chu. British residences and Darjeeling, p. a tower 200 feet in height and a sull, which is one of the triumphs of art. Tanjore is an educational centre for Sanskrit literature, and has a college.
TANK

An engine of war first used by the
their attack on the Somme (France)
invented by Maj.-Gen. Stockton, Cal. It was afterward
a various forms by French, United
German armies. Essentially a
carrying machine other light pieces, it is capable of
making its way over obstacles such
the battlefishe for the protection of
d the ancient Roman
to make it was invented to
over great firing power of defending
an general staff had learned the de
the machine gun as demon

During the World War of 1914-1918 and elsewhere
the Japanese War and had not only ac
thousands of these weapons but had
bers of trained units to handle them.
the first years of the war machine
on attack and defense, proved tre
ductive to the Allies, and as
down into trench warfare their
was even increased. Hidden un
during the artillery preparation for
they could be brought out at the
in action an enormous toll. General
E. D. Swinton, of the Royal
and later of the British War Cabinet,
amous "Eye-witness" of the early
the war, officially commissioned to
ly fighting for the press and public
ion gave him exceptional oppor
tation all along the western front.
ctor used by the British
ging huge guns over difficult fields
to the idea of a self-propelled
y enough to withstand all but the
d enemy fire and yet mobile
or conditions. During the course
paid Mr. Holt by General Swinton
he tank inventor told the story: "In
a mining engineer,
ing for a cheap system of transpor
tle wrote me and said, 'I struck a
chine in Antwerp that they call a
ttractor. This machine climbs
up the slope of a hill by means of
oring a machine ever since the time of
I thought, if this tractor climbs
what we want is something that will
beat hell. At the beginning of the
peculiar position, with a knowledge
of the needs and the chance of discovering
many new things. One thing was that the
Germans had secretly armed themselves with
thousands of machine guns. The machine gun
is the most perfect man-killing gun ever made.
The Germans manufactured it in England un
under a British royalty. For a time before the
war broke out they did not pay any taxes or
submit any accounts. They knew the
war was coming and they started it with 50,000
of these guns ready. They used them like artists.
Our men went out against them and were
mowed down by thousands.

It appeared that the idea I had in July
1914 might produce a machine that would climb,
which was absolutely right. It was obvious
that launching assaults on enemy positions un
less they were first blown to dust was merely
to throw infantry into a maze of barbed wire
in which they would be caught helpless, like
flies on 'tanglefoot,' and mown down by rifle
or machine-gun fire poured in at short range
from all directions. We had to have something
to go across trenches and over barbed wire.

The machine gun was proving to be a disease
against humanity. It was invented by the late
Hiram Maxim, so you Americans have the
credit of producing that disease. But you have
the credit of producing the antidote, too — the
'caterpillar' tractor, invented by Benjamin
Holt. We started out to make that climbing
machine, the machine-gun destroyer. We made
a large number of them between August 1916
and March 1917, and kept it a secret. It
had been whispered around that they were reser
voirs to take water to our troops in Egypt.
'Reservoirs' was good camouflage, but it was a
long word, and 'tank' was better. The name
stuck. They were a surprise to the Germans.
They have taken thousands of prisoners and
have saved thousands of lives. Frederick
Palmer, the American war correspondent, esti
mated that they saved 20,000 lives on the
Somme and as many more at Cambrai, in 1917.
Not only have the tanks saved life by the moral
effect of their approach and by the number of
machine guns put out of action — but they have
themselves have taken thousands of lives."

The tanks owe their success to two essenti
first, the internal combustion engine, which
has also made feasible the use in war of the
airplane, submarine and motorized artillery, and,
second, the traction or propelling device de
veloped by Holt and established throughout the
world as a commercial success without definite
forethought as to its application in war. The
main features of this mechanism are a track
on either side of the machine, composed of a
series of steel shoes suitably linked together,
with joints protected from mud and dust; idler
pulleys for laying the shoes down in front and
driving sprockets for picking them up again
in the rear; and uprights on the inner surface of
the shoes to form continuous rail-like bands
upon which roll the truck wheels carrying the
weight of the machine. 'Caterpillar' and tank
have this much in common, that they lay down
their own rails and roll over them. Aside from
that their purpose and construction are quite
different. The tractor is a towing machine,
used in war for the rapid, certain handling of
guns and supplies, not completely armored and
not intended for trench-line duty. The war
tractor is practically a mere duplicate of those used on thousands of farms and industrial locations throughout the world. The British, Russian, French and American armies, however, adopted it as the one feasible means of moving heavy mobile artillery over difficult ground, which was not feasible in the conventional means of transport. The tractor was developed by the British and French armies, who saw the need for a machine that could carry heavy artillery and supplies over rough terrain. The tractor was designed to be simple and rugged, with a large turning radius and a high ground clearance. It was powered by a powerful engine, which allowed it to pull heavy loads over long distances. The tractor was built in large numbers, and was used extensively in all the major theatres of war during World War I. The tractor was a key factor in the Allied victory, as it allowed the Allies to maintain a strong presence on the battlefield, even in the most difficult conditions.
contains less nitrogen than dried blood: phosphoric acid. The considerable in its composition is exposed by the table, taken from Steyves's 'Soils fertilizers,' all from one factory:

<table>
<thead>
<tr>
<th>Year</th>
<th>Phosphoric Acid</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>10.5</td>
</tr>
<tr>
<td>2nd</td>
<td>9.8</td>
</tr>
<tr>
<td>3rd</td>
<td>10.9</td>
</tr>
</tbody>
</table>

A general way 5 to 8 per cent of nitro-<e>gen is expected and from 5 to 12 per cent of acid. In its action on the soil it is than dried blood. It is an excellent fertilizer and is also used for field proper rotation and as a top-screening land. As tankage in its full strength be allowed to come in contact with usually applied several days before operations, or else a special fertilizer drill is used which places it near but contact with the seed. Two hundred pounds per acre is computed as a saing, but as high as 400 pounds can applied under certain conditions. In her an excessive application (say 800 will destroy vegetation. Of course the fertilizer advisable must be according to the composition of the erie soil is badly impoverished a portion or tankage can be usefully than on one kept up in good quality. of its comparatively slow action tankage should be used in as finely ground condition and should be applied to the soil view to its permanent benefit rather direct food for a certain crop. Tankage, a certain type and content is also a hog-feed with good results when to corn or other food rich in carbo- or fats but poor in protein content. used for feeding dairy-cows and in beef cattle for market. See Fertil- Stock, the Feeding of.

NAHILL, tän'ah-il, Robert, Scottish ter: b. Paisley, 3 June 1774; d. there, 810. He received little education, hav- appanected to a weaver at an early wrote some of his songs while work- he made the acquaintance of Robert Archibald Smith, a Scottish, who set a number of his songs to in 1807 he published the first edition Poems and Songs; a second edition cluted by the publisher, Tannahill, re- and drowned himself. In edared a complete collection of his writ- h a memoir by Ramsay.

NER, tän'ér, Benjamin Tucker, Afri- host bishop: b. Pittsburgh, Pa., 25 5. He was educated at Avery College, y, Pa., and at Western Theological 7. He was editor of the Christian for 16 years, founded and was years editor of the A. M. E. Church and in 1888 was appointed bishop. He alegate to the third Ecumenical Meth- rinary held in London in 1801, and lished 'The Origin of the Negro' 'The Negro in Holy Writ'; 'The l Solomon — What?,' etc.

NER, Henry Ossawa, American on of B. T. Tanner (q.v.): b. Pitts- burgh, Pa., 21 June 1859. He studied under Thomas Eakins at the Pennsylvania Academy of Fine Arts subsequently removing to Paris. He became the pupil of Jean Paul Laurens and Benjamin Constant. In the Salon of 1896 he received honorable mention and a third class medal in 1897. He was awarded the Walter Lippincott Prize, Philadelphia, in 1900; Second Medal, Paris Exposition, in the same year; and medals at the Buffalo, Saint Louis and San Francisco expositions. He is rep- by paintings in the Luxembourg, the Wiltstach Collection, and at the Pennsylvania Academy of Fine Arts, Philadelphia.

TANNER, James, American lawyer and public official: b. Richmondville, N. Y., 4 April 1844. He enlisted in the 87th New York vol- uenteers and was soon promoted its corporal. Losing both legs in the second battle of Bull Run, he returned to New York, studied law, and was admitted to the bar in 1869. He re- ceived an appointment at the New York cus- ition and became deputy collector. From 1877-85 he was tax collector of Brooklyn and in 1889 was appointed United States commis- sioner of pensions, but later resigned to be- come a pension attorney. He fought tirelessly against the government 1899-1904. On 1 April 1904 he was appointed register of wills, Dis- trict of Columbia by President Roosevelt. From 1870 he was deputy-commander of the Grand Army of the Republic, New York, and 1906-06, commander-in-chief.

TANNER, John Riley, American soldier and statesman: b. Warwick County, Ind., 4 April 1844; d. Springfield, III., 23 May 1901. He enlisted in the 98th Illinois volunteers in 1863, and was with Sherman's army during its active campaign in Georgia, Tennessee and Alabama. Returning to Illinois after the war, he engaged in farming and selling fruit trees, entered politics in 1870, as Republican can- date for sheriff, was elected, and held there- after offices of circuit clerk 1872-76, State senato 1880-83, United States marshal 1883- 85, State treasurer 1886-88, assistant United States treasurer, Chicago, 1892-93 governor of Illinois 1896-1900. He was the recognized leader of the Republican party in Illinois, was the first in Illinois to speak openly for a single gold standard, declaring himself therein early 1895, and as governor his administration was able, efficient and economical. Immediately after the blowing up of the Maine in Havana Harbor, he secured the passage of resolutions in the legislature, tendering to the national government the material and moral support of Illinois in the event of war with Spain, and within 36 hours after the call for troops he had mobilized 10,000 men at Springfield, thus procuring for Illinois the honor of having the first regiment ready for muster into the na- tional service. His vigorous stand against the importation of contract labor under arms at the time of the Virden riots brought about a storm of protests that his acts were without precedent and unconstitutional. They were met with the answer that he would make pre- ceedents and construe the Constitution and the law for the welfare of the State.

TANHAUSER, tän'ho-i-zér, German min- nesinger, probably of Salzburg or Bavaria, who
TANNING

in the 13th century appears at the court of
Frederick the Warlike and other princes. He
led a monastic life and used Neidhart (q.v.)
as his model, celebrated in song the loves of the
Barbarian peasantry.

A didactic poem 'Hofzucht,' (Court Behavior)
is also attributed to him. He is credited with
the original tale of Tannhäuser the knight.

This chivalrous knight in the course of his
wanderings meets a sage named Hilario, who
instructs him in secret lore. At the same
city a lady called Lisaura conceives a violent
passion for him which he returns. Gradually,
however, the tales of his instructor regarding
spiritual beings lead him to desire association
with some beautiful spirit in mortal form.

Hilario assures him that he may attain this
at Venusberg, a hill near Freiburg, where
Venus holds her court in the midst of all de-
lights. Tannhäuser starts for the haunt of
the goddess, on hearing of which Lisaura kills
herself. For a long time the knight remains
in Venusberg, but at last his conscience touches
him, he thinks with regret of Lisaura, and
leaves Venusberg. At that time the pain of
Cain is as it is for the staff which he holds in his
hand to bud and bring forth green leaves. Despair-
ing, the knight retires and enters the Venus-
berg once more. Meanwhile the Pope's staff
has actually begun to sprout, and Urban, taking
this as a sign from God that there is still an
opportunity of pardon and salvation for the
knight, hastily sends messengers into all lands
to seek for him. But Tannhäuser is no longer
to be found, and never again appears on earth.
The Tannhäuser legend has frequently received
poetic treatment, and Richard Wagner has
adopted it (with modifications) as the subject
of one of his operas. Consult Zander, 'Die
Tannhäuser-sage und der Minnesinger Tann-
häuser;' (1880); Baring-Gould, 'Popular
Myths of the Middle Ages.'

TANNING, broadly speaking, the art of
converting the skins of animals into leather.
The skin of most of the higher animals con-
sists from the tanner's point of view of two
layers, the outer containing coloring matter,
the roots of the hair or fur, and being cellular
in structure; the inner being thicker and of
fibrous structure. The outer layer is decom-
posed much more easily than the inner by the
action of alkalis; the latter is only soluble in
water after protracted boiling, yielding a solu-
tion which gelatinizes upon cooling. Moist skin
undergoes putrefaction when exposed to the air
for some time. Dried skin is hard and brittle.

In preparing leather the object of the tanner is,
in the first place, to remove the outer layer
of the skin together with all adhering hair,
and, in the second place, to bring about such
a change in the under layer as shall prevent
it from putrefying in moist air, and at the
same time render it indifferent to moisture,
water, chemicals, etc., with the utmost sup-
pleness. The process of tanning, therefore,
divides itself into two parts. (1) Cleasning
the skin and removing the outer layer; (2) con-
verting the inner layer into leather. Techni-
cally only the second part of this process mens
the title of tanning. As supplementary to
these there is the dressing and currying the leather. The skins used by
the tanner are principally those of cattle;
the skins of horses, asses, pigs, goats, d
alligators and many other animals are
converted into leather. The quality of the
leather varies in different species of animals
in the same species, depending upon
and amount of the food consumed, and to a
still greater degree upon the vicissitudes
climate in which they are reared. Wild
cattle are said to furnish hides superior to those
domestic cattle.

In the first stage of the process, having been thoroughly washed and
of tails, shanks and pates are soaked in water
until they are sufficiently soft to allow of
adhering flesh and muscle being scraped of
means of a blunt knife; this softening proc-
gress is generally aided by beating the hides
of hammers or sticks worked by machinery.

The first is of great importance that the water be soft,
it necessary so calls upon the hides when
are green, 24 hours are allowed for the
soaking, and an equal period for a second
soaking in a fresh bath. They are use
halved lengthwise between the two soaks.
Dry hides are soaked 24 hours in water,
containing sodium sulphide, then halved and
through a dry mill for nearly an hour
then stacked up in piles for another 24 hours.
They are then put back into the same
24 hours more, again milled. Then fleshed
put into cold, clean water overnight. If
soaking is too prolonged the skin can
made into good leather. The hides are then
generally placed in pits with milk of
whereby the hair and upper layer of skin
gradually loosened. This operation requires
about six days, the hides being changed to
a fresh lime bath. They are then
subjected to the action of the dressing.
The final process preparatory to tanning
sists in hating the hides in a very dilute
liquid in which a mild putrefactive ac-
tion is going on. This bath is made with lactic acid and glucose, the
furnishing the fermentative ingredient.
Hides, which continues for six days, the
is entirely removed and the hides are
considerably softened and swollen. The
pared hides may now be tanned — that is
able to withstand putrefaction without
of suppleness — by the action of diffe-
materials. These materials may be two
ited as (1) tannin, (2) metallic salts
 oily matters. When tannin is used it
always called tanning. When metal
are used the process is in some
socalled tawing; and when oily matters are
shamming or oil-tawing.

Vegetable Tanning.— The sources of
in used in the vegetable tanning proc-
chiefly oak bark and hemlock bark. The
is taken from the yellow and red oak,
all oaks carry a proportion of tannin, which may be available for this purpose.
The tannin content of the best oak bark
from 9 to 14 per cent. Hemlock bark is
much larger supply, and, therefore, is more
largely used. It carries from 7 to 8 per cent.
gradually increasing strength. The tannin is thus caused to penetrate the hides completely. The thinner hides must be immersed for 6 or 8 weeks, the thicker for 12 or 24 weeks in the tanning liquor. A more rapid process is obtained by combining the tanning agents. A liquor compound with quebracho extract and palmetto extract is one of the quickest, and the leather may be pressed and split and the grains retained after 18 to 20 days. The modern tanner divides his work into three stages: in the first the hides are colored by immersion for 24 hours in a weak liquor, activated by one part of hemlock to two parts of quebracho; in the second stage the tanning process is carried forward by strengthening the liquor by fresh additions twice daily until it tests 30° (barometer); the third stage follows the pressing to remove superfluous liquor and the splitting of the hide into grains, and is a retanning process with a strong gambier and sumac liquor; for about one hour. The entire process may be completed within eight days.

Mineral Tanning.—This process depends upon the action of chromic acid instead of tannic acid. Of very recent introduction the chrome process has extensively displaced the much slower tannic acid processes and its product seems equally durable and acceptable in the industries. After the hides are bated and washed they are pickled with sulphuric acid and salt or with aluminum sulphate and salt. They are then put into a solution of salt in a vat with paddles, and the paddles run for half an hour. The chrome liquor, a compound of potassium bichromate and sulphuric or muriatic acid, is then added until the bath reaches 50° B., the paddles running for one hour. More of the chrome liquor is then added, and the paddles run for three hours longer. The remainder of the chrome is then added and the hides left until the tanning is complete, which will take about six hours. They are left in the liquor for 12 hours longer and then pressed and placed in a second bath of sulphurous acid and finally washed with a solution of salt, when they are ready for splitting and retanning with gambier or palmetto. This is the process commonly employed in making calfskin, goatskin and sheepskin leathers, though they are often tanned with alum. In the latter case, when the skins have been washed and prepared by being submitted to processes closely resembling those already described they are separately soaked in a tepid bath containing alum and common salt dissolved in water; they are then, without being dried, placed in heaps for a few days, after which they are wrung out and dried slowly by exposure to air. The alum bath for 10 skins is usually prepared by dissolving 0.70 kilos of alum and 0.30 kilos of common salt in 22.5 litres of boiling water. Aluminium chloride is produced by the action of the salt and alum, and is absorbed largely by the skins; the excess of salt appears also to aid in the conversion of the skins into leather. The tawed and dried skins are softened by being dampened and stretched between a curved iron and a movable steel plate, after which they are again dried. Heavy hides are sometimes tawed for the use of the saddler by steeping them in a bath containing a larger
TANNINS

quantities of alum and salt than that mentioned above, drying them and then rubbing them with tallow before a charcoal fire. A very strong leather may thus be prepared in a comparatively short time. The more delicate kinds of leathers, however, require that for making kid, gloves, kid shoes, etc., be tawed by immersion in a bath containing alum, salt, yolk of eggs, wheaten flour, and water. The oil contained in the egg yolks confers upon the leather a great degree of softness, the gluten of the flour seems to aid the skin in the absorption of aluminochloride. The skins are stretched by hand and rapidly dried in the open air; they are then damped, placed between linen cloths and trodden upon until they become soft. They are finally polished by rubbing with a glass disc smeared with white of egg or a solution of gum, etc.

Oil Tawing.—So-called wash leather or chamois leather is prepared from the skins of deer, sheep, calves, etc., by tawing them with oil. The skins having been washed, limed, etc., in the ordinary way, are repeatedly rubbed with animal oil, exposed to the beaters of a fulling machine, and dried. The oil employed is turpentine oil. It is believed to replace castor oil with sulphuric acid. Other oils have been employed, but castor oil remains the only oil which has been successfully sulphonated. A small quantity of carbolic acid is sometimes added. The skins are stretched and sprinkled with oil, which is gently rubbed in with the hand; they are then placed in bundles in the fulling machine and exposed to the action of the beaters for several hours. After exposure to the air the skins are again rubbed with oil and again placed under the beaters; these processes are repeated until the fleshy odor of the original skin is no longer perceptible. By exposure to a warm atmosphere a process of gentle fermentation is originated within the skins, whereby the pores are dilated and the oil is enabled to penetrate the mass more thoroughly. The excess of oil is finally removed by washing with a dilute warm caustic lye; the skins are then dried and dressed. Wash-leather is much used for making military belts, gloves, socks, etc., for surgical bandages, stuffed chair coverings, and for polishing jewelry. A great variety of other processes are in use for tanning, many of them being patented. These formulas call for such ingredients as witch hazel, horse chestnut, poke-root, cranberry, blackberry roots, persimmon bark, licorice, fornic aldehyde, sodium nitrate, chromium chloride, iron sulphate, zinc sulphate, etc. For specific purposes these may have other uses, but the basic processes of tanning have remained unchanged for many years.

The manner in which tanning is conducted in different establishments varies much in detail, although the general principles are the same. In some of the older processes, which might be expected from ancient knowledge, each tanner treasures his secret as to the best process for bringing about the desired modification of which it is competent to speak. And these secret methods, the value of which can be proved by skillful experience, is inevitably overestimated by those whose knowledge is confined to that experience, prevent comparison and the rejection of superfluous and perhaps injurious operations. The trade of tanning may, however, be still in its infancy, and it must be that the chemical processes involved has been solved. It was only at the 18th century that scientific methods were applied to leather-making, and a much progress has hitherto been considerable activity has been shown in the improvement. The extreme slowness of leather-making by any of the ordinary processes of tanning has afforded motive for inquiry as to whether hastening it by additional contrivances has been saved by splitting the as it comes from the lime pits, and tannin thinner splits individually. The neces:

preserving the solidity and tenacity of hides seems to militate against any method of progress in the passage of tanning agents through and through them.

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TANNINS, or TANNIC ACIDS, are pound of high molecular weight, wide distributed in the vegetable kingdom. Some of are found in diseased vegetable tis in abnormal growths, while others are in the different parts of the healthy Gallotannic acid is present in gall-nut, tannic acid in coffee beans, tannin in yellow wood, quercetin acid in oak ellagitannic acid in pomegranate. These tannins are not by any means in all their physical properties and their conduct; still they possess some char acties in common. They are usually amo have an astringent taste, dissolve in hot convert animal hide into leather and yield blue or green precipitates with ferric sa these varieties gallotannic — the chi stitution of the commercial product — ha any other tannin, received the att of investigators. The statements in this refer chiefly to this compound.

Gallotannic acid is extracted from po calls by treatment with aqueous or al alcohol. On standing the mother liquor an upper layer containing gallic acid other impurities and into a lower layer which crude tannic acid is obtained by tannin evaporation. From this produ impurities may be further removed by tre with dry ether in which the acid is int ethyl acetate and acetone have also bee quite extensively for the extraction and preparation of tannic acid. The compou further been purified by treating its
or suspension with lead acetate. This precipitate a lead salt which is readily used with hydrogen sulphide.

This precipitate is a substance with astrignent taste, soluble in water, or alcohol, glycerine, ethyl acetate and almost insoluble in dry ether, chlorophene, carbon bisulphide and petroleum.

Its aqueous solution gives an acid with litmus, although its acidity cannot be determined by direct titration, an indication practically valueless. With pure salts aqueous solutions of tannic acid coloration at first, but a color is soon developed by atmospheric oxidation and a blue-recipitate is ultimately formed. With salts a bluish-black precipitate is at once produced; this reaction is taken as the basis for the estimation of the compound in the preparation of ink inks. Cold alkaline solutions of acid absorb atmospheric oxygen very slowly in forming highly-colored oxidation products. A similar acid solution forms precipitates with metallic salts, with a number of acids, with nearly all alkaloids and their salts, albumin, gelatin, starch, and gelatin, albumin, and starch. A solution of the acid is converted into leather. At 215° C. the acid decomposes into water, carbon dioxide, and metagallic acid and dinitro dihydric acid. It is hydrolyzed by gallic acid.

Anic acid is extensively employed in the manufacture of gallic acid, in the preparation of ink dyes and in dyeing. With formaldehyde forms a condensation product which in the manufacture of hygienic fabrics and acid has found extensive application in medicine. It is recommended as an anti-metabolic poison with which it usually nontoxic precipitates. It is employed as a mordant to prevent excessive secretion in sores and to check bleeding. Tannin (tannyl triacetate), tannic acid (gelatin), tannin and bismuth tannate have been employed in intestinal caustic. Tannic acid is also used in tannin, and in the treatment of skin diseases, tannin in the treatment of scalp diseases.

though oak-bark, gall-nuts and other sources of tannic acid had been used incidentally, the compound was first isolated by Scheele in 1787. Benzilifer assigned to it the formula C${}_4$H${}_8$O${}_6$. (1834) modified this to C${}_4$H${}_8$O${}_4$. In olden called attention to the hydrolysis of acid into gallic acid. Siemen believed that this acid was a glucoside, which three molecules of gallic acid existed with one molecule of glucose; while up to the present day have contended that purified substance contains no sugar. Schiff claimed to have converted gallic acid into tannic acid by a process of condensation called his product digallic acid and its use in the formula C${}_4$H${}_8$O${}_6$, which had been adopted by some earlier investigators. Digitalis extract has been used for many years, but in 1890 Ph. van Nist, C. Scheible and others made the discovery that tannic acid was optically active, and that rendered Schiff's digallic acid form improbable. After several years of study Nierstein (1908) announced the conviction that tannic acid was a mixture of Schiff's digallic acid and optimum tannin. While Emil Fischer's researches with the carefully purified substance pointed to the conclusion that tannic acid might be considered as a compound of one molecule of glucose with 10 molecules of gallic acid. The hydrolysis of the compound into glucose and gallic acid, as well as its synthesis, are cited as possible confirmations of this view. At the same time it is frankly admitted that the question of structure has not received its final settlement.

Of late years compounds showing the properties of tannic acid have been prepared by synthetic processes. Of these so-called *Syns.-tanis,* Neradol and Neradol D deserve mention. They are obtained by heating phenol sulfonic acids with formaldehyde. It is claimed that the amount of Neradol required to treat skin is less than that of any vegetable tannin.

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TANOAN, t'a-no-an, or TAHANO, FAMILY, a linguistic stock of American Indians inhabiting a group of pueblos in the Rio Grande Valley, New Mexico. The chief of the modern villages are Isleta, Jemez, Picuris, Pojoaque, San Ildefonso, San Juan, Sandia, Santa Clara and Taos. They are considered the most representative pueblo group, and are probably the most ancient of the pueblo settlements. The villagers who number about 3,000 have not perceptibly advanced in civilization, from the descriptions given of them by Spanish explorers who first visited the villages over three centuries ago. Deriving their name from Tahano, the Indian name of the chief Tano pueblo, they then inhabited a number of other villages, now in ruins, in Mexico, Texas and Arizona grouped under the names Tano, Tewa, Tigua and Piro. Consult Bandelier, H. F. A., 'The Indians of the Southwestern United States, 1880-91' (Boston 1890-92).

TA'NON, tâ-nôn', a strait in the Philippine Islands between Cebu on the east and Negros on the west; the northern entrance is 20 miles wide and the southern entrance five miles; the length is 103 miles. The shores are steep and generally free from obstructions; there are a number of important towns on its coasts.

TANREC, or TENREC, a genus (Centetes) of insectivorous mammals, distinguished by the elongated muzzle and the short rounded ears. The body is covered on the upper surface with spines and bristles; no tail exists. These animals inhabit Madagascar, the most familiar species being the centetes ecaudatus, while other species are the tendrac or spiny tanrec (C. spinosus) and the banded tanrec (C. madagascariensis). The C. ecaudatus is an animal of about the size of the European hedgehog, but with a larger body, the legs being also more elongated. The quills or spines are yellowish at their bases and black toward the tips. These animals hibernate like the European hedgehogs and live in burrows, which they excavate by means of their strong claws. They do not, however, possess the power of rolling themselves up into a ball-like form for defense. The food consists of insects, rep-
TANSY, a composite herb (Tanacetum vulgare), introduced into America from the northern Old World. It is a familiar weed of waste lands and roadsides, probably escaped from old herb gardens and maintaining its position with vigor—a characteristic which is said to have suggested the Greek name Athanasia, "immortality," which has been corrupted into "tansy." It is a handsome plant, with dark-green, deeply cleft and pinnaed, fern-like leaves, numerous on an erect stem about three feet high, which is topped by something dense of round flat, button-like, gold-colored heads of rayless florets. It has a rank odor and bitter, aromatic flavor, which caused it to be used formerly as a seasoning herb, a practice now practically obsolete. The acid juice contains a volatile oil that is very poisonous, yet tansy was a popular anthelmintic and stomachic drug and still holds a place in materia medica as an aromatic, bitters and irritable narcotic; it is employed to relieve the pain of ulcers, bruises and rheumatism. White tansy is the sneezewort, and several other plants of similar aspect are also called tansy; while Argentiniana anserina is the goose-tansy.

TANTA, or TANTAH, ðn-tä, Egypt, capital of the province of Gharibeh, in the Delta, about 55 miles by rail north of Cairo. It has large public buildings, a palace of the Khedive, bazaars and three important annual fairs. The centre of education is the Mosque of El Ahmadi where in 1914 2,860 students and 113 professors were registered. Pop. about 59,000.

TANTALITE. A rare mineral consisting of tantalum of iron and manganese, with 72.4 per cent of tantalum when pure. An important source of that metal, at one time used extensively for filaments for incandescent electric lamps; obtained in Black Hills of South Dakota and in Virginia.

TANTALUM, chemical symbol Ta, atomic weight 183, is a rare element found by Ekeberg (1863) in a mineral afterward called tantalite (Pillowite) obtained from Finland. It is also found in the minerals sarsamkite, yttrotantalite and fergusonite. The other rare element columbium is usually found with it. The metal is obtained by heating the potassium and tantalum hydroxides with metallic potassium and extracting the potassium fluoride with water. It is a black substance with a metallic lustre, insoluble in sulfuric, hydrochloric or nitric acids or aqua regia, but soluble in hydrofluoric acid. Like columbium it ignites when heated in the air, forming tantalum oxide, Ta₂O. This oxide unites with certain metallic oxides or hydroxides to form compounds called tantalates which may be considered as derived from hypothetical acids called tantalic acids. Tantalum is used in the manufacture of electric lamps. It is found in pegmatite veins in the Black Hills of South Dakota and at other places in the United States. The chief supply comes from Australia and Scandinavia.

TANTALUS, ðn-tä-läs, in Greek mythology, king of Lydia; son of Zeus or Tmolus. Tradition does not agree as to the crime by which he forfeited the favor of Zeus and merited confign punishment. According to one account he offended Zeus by his perjury; according to another he stole away the nectar and ambrosia from heaven, and a third story is that he murdered his own son Pelops and served him up as some of the gods. Homer represents him as standing up to his throat in water, with the most delicious fruits hanging over his head, which, when he attempts to quench his thirst or to appease his hunger, elude his grasp. According to Pindar a great rock is suspended over his head, which constantly threatens to fall and crush him.

TANTIA TOPI, tân-tēâ tōpē ("the weaver who became an artilleryman"): h. Bithur, near Cawnpore, India, about 1819; d. 18 April 1859. Rebel leader during the Indian Mutiny of 1857. He displayed marked ability, beginning as a lieutenant of Nana Sahib, after the flight of the latter into Nepal, he assumed command and continued the war for months, putting the English to no end of trouble, being the last rebel, with his entire army, to be captured, tried and hanged in April 1859.

TANTRA, the name given in Hindu religious lore, to dialogues between the god Siva and his bride in one of her many forms, but chiefly as Uma and Parvati. The Tantriks or followers of the Tantras, consider them a fifth Veda and attribute to them equal antiquity and superior authority. In them is found instruction in the methods of acquiring six superior faculties, as what would now be termed clairvoyance, second sight, observation on the astral plane, viewing the body, etc. Meditation and its results is dealt with at great length, breathing instructions are given that suggest modern Yoga practice and there is instruction in the languages of animals Consult "The Tantra of the Great Liberator" (trans. London 1913). See INDIA.

TANTUM ERGO, tän-tüm er-go, the hymn sung in the Roman Catholic Church at benediction with the Holy Sacrament.

TANZIMAT. See TURKEY, GOVERNMENT.

TAO TE KING. Laotze, author of the "Taô Te King," "Book of the Way and Virtue," lived in the 6th century B.C, and was keeper of the archives at the capital where Kongtse (Confucius) visited him. Later many legends, borrowed from Buddhism, gathered around his memory, until he became chief deity of the Taoists and his "Taô Te King," their chief scripture. (See Taoism). The "Taô Te King" treats the world, man, morality and politics in reference to Tao, variously translated Way, Word, Reason, Nature, God. An understanding of the "Taô Te King" is greatly aided by familiarity with Brahmanic and other mysticism; and Douglas even supposes that Laotze derived his doctrines from India; but if so he thoroughly assimilated it to the Chinese mind, while his references to Chinese antiquity indicate originality. In any case, Tao is distinguished from the ontological Brahma by the characteristic Chinese stress upon its ethical content, Tao is the Absolute which unfolds its mysterious nature into Shang-ti (the Chinese personal god), the rational world, and moral man; and it may draw all three again into itself. After introducing his Tao, Laotze passes from one theme
er without logical sequence, but always
to exemplify the working of Tao, as usual with the Chinese, to the moral
tical spheres. Laotze was no philosopher;
but, like his great rival, Kung-tse, was
a remedy for the troublous times in
he lived. Laotze's remedy was a re-
Arcadian simplicity, such as existed be-
less and laws were devised or needed.
ismissimistic rejection of entire human
Laotze constantly joined rejection of
features, such as ambition, pride,
y and greed; while he commends its
weak but indispensable elements.
course of this exposition, many a gem
is brought to light, though often ed in dull earth.
tions from the 'Tao Te King',
nd the sage, in the exercise of his
nt, empties the people's minds, fills
plies, weakens their wills, strengthens
es. He constantly tries to keep them
knowledge and without desire, and
there are those who have knowledge,
them from presuming to act on it.
there is this abstinence from action,
der is universal.
ere is no guilt greater than to sanction
, no calamity greater than to be dis-
osed with one's lot, no fault greater than
h to be getting. Therefore the suf-
contentment is an enduring and un-
g sufficiency.
those who are good to me, I am good;
those who are not good to me, I am
od, and thus all get to be good. To
ho are sincere with me, I am sincere;
those who are not sincere with me, I
in, and thus all get to be sincere.
e does not accumulate for himself. The
hat he expends for others, the more
possess of his own; the more that he
others, the more does he have himself.
Legge. I. The 'Teachings of Taoism' (2
Sacred Books of the East').
EDMUND BUCKLEY.

TAOISM. Taoism ranks with Confucian-
Buddhism as the three great religions
a, which amount in practice to one re-
compound, wherein Confucianism is
oral and ceremonial. Taoism is re-
and magical, while Buddhism deals in
chosis and the future life. Only the
are exclusive followers of either Taoism
hism. There are even 'temples of the
ines', where idols of Buddha and
and stand on either side of Kongtze. The
ask about a religion not, 'Is it true?'
it moral?'. Tested thus, all their re-
seem to the Chinese acceptable.
ism is the folklore of the Chinese,
but having received various accretions
the centuries, such as a corrupted form
ze's doctrine of the Tao (from which
takes its name) in the 6th century B.C.,
defined as Yu Hwang in the 7th A.D. and
Kwan-tze, both of whom are defined as
d only in 1828. Especially in the three
5 B.C., emperors and folk alike, under
ership of Taoist priests, neglected labor
for the elixir of life and for power
bility become gold. Thus
cluded to include most of the national
hero-worship and nature-worship (of a type
lower than Confucianism) and most of the
divination and magic, the latter including
fengshui, the Chinese geomancy, according
to which the location of a house or a grave de-
deps on supposed magnetic currents; the azure
dragon, the white tiger and the like. This folly
strong enough to form the chief obstacle to
civil engineering in China, as when a telegraph
pole would disturb the fengshui of a region or
a railway that of a century!
The gods of Taoism furnish a good index
to its heterogeneous origin. The San Ching,
"Three Pure Ones," are simply a tripllication
of Laotze, done to correspond with a Buddhist
triplet. But, since these are sunk in contempla-
tion, the superintendence of mundane affairs
falls to Yu Hwang Shang Ti, "Gemmous
Sovereign God." The first elements have souls
which rose to become the five planets and thus
divine. Many stars are defined. The Dragon-
kong, a familiar feature of Chinese processions,
seen even in America, represents water in its
varied forms and, therefore, has numerous
temples besides seas and rivers and is discerned
among rain clouds. Sun cult survives in the
bonfires of the spring festival. Licentious fes-
tivals were long ago suppressed in accord with
the politico-ethical nature of the dominant Con-
ufucianism. Sacred animals are the fox, snake,
edgehog and weasel; sacred trees are the cas-
sia, willow, banyan, pine and peach. To the
ancestral tablets and an image or picture of the
Kitchen-god (originally a Fire-god) found in
every Chinese house the Taoist adds certain
other figures according to locality, trade and
preference.
Taoist worship also certain culture-gods
who preside over various vocations. Thus,
students revere Wan-chang (a deified scholar)
as God of Letters, soldiers worship a deified
soldier as Kwanti the God of War and traders
people worship Tsai-Shin, God of Riches. Be-
sides such great gods there are innumerable
"spirits," of whom Chinese live in dread by
day and especially night.

The priests of Taoism are probably cognate
with the shaman of Siberia, but its monks,
nuns, pope, monasteries and temples were
copied from Buddhism. These priests conduct
the ritual for the city and State gods, for
fty streets, houses and persons from evil spirits,
and prepare paper amulets for pasting on door-
ways to exclude spirits. Though Taoist priests
marry, their vocation is not hereditary, they are
recruited from the lowest classes, are ignorant
and immoral, and are generally despised by the
"literati", the learned officials of China. From
these priest-magicians one must distinguish the
monks who observe Laotze's principles by
 celibacy, seclusion and mystical communing.

The Taoist scripture is far less the recondite
'Tao Te King' (q.v.) of Laotze than "The
Tractate of Actions and their Retributions," an
anonymous tract composed about the 11th cen-
tury A.D., which is universally popular. Its 212
brief statements fall under five headings, the
first of these declares that happiness follows
virtue as misery follows vice; the second states
that "spirits in heaven and earth," in "the great
Bear constellation" and within "men's person"
vortices man must practice and their reward in
making him an "immortal"; the fourth, and by
far the longest, names the vices he must shun;
while the fifth provides for repentance and
enacts a new rule of theology. The tract is
characteristically Chinese, agreeing with Con-
fucianism in its stress upon morality and in its
belief in an earthly theology; but its doctrine of
the Buddhist pantheon, as developed in a Bud-
dhist. Another popular religious tract, the
"Book of Secret Blessings," expresses in 541
words brief moral rules with a flavor equally of
Taoism, Confucianism and Buddhism, by all
of which indeed it is approved.

In centuries Taoism further adopted from Bud-
dhism its doctrine of hells and it exhibits in its
temples realistic figures of the damned under
torture. Foreigners name such a temple
"Chamber of Horrors," and its gruesome
spectacles are well adapted to terrorize the ob-
tuse minds of the Chinese masses.

Consult Mayers, W. F., "The Chinese
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in China" (1884); Douglas, K. K., "Con-
fucianism in China" (1914); Legge, J.,
"The Texts of Taoism," 2 vols., in "Sacred
Books of the East."

EDMUND BUCKLEY.

TAPAJOS, tâ-pâ-zhôs, Brazil, a tributary of
the Amazon, formed by the confluence of the
Arimas and Jurunena, which rise on the edge of
the Brazilian plateau in the state of Mato
Grosso. The main stream is at first hemmed in
by mountains and obstructed at intervals by
rapids, but after it enters the state of Para it
is a broad and deep stream. It enters the
Amazon at Santarem in about long 54° 20' W.
A few miles above its mouth it broadens into a
lake-like expansion 12 miles wide and 75 miles
long. The river is 1,040 miles long and steam-
ers ply on it for 210 miles.

TAPESTRIES. The peristromata of the
ancient Babylonians were highly praised by
Homer, Hesiod, Thucydides, Strabo, and,
Palaces and temples of the 13th and 12th
centuries were covered with tapestry hangings;
the houses of the 12th century, were of embroidery work,
not woven. The walls of many European Con-
tempar churches and princely palaces were
covered with rich warp 
kaute (fr. tapestry) hangings by the 14th century. The terry-
lookers are used as the walls of halls in manors of the 14th century from which the
pictures were suspended. Certain tapestry hangings are still in the remains of the Arcadian
Empire (Eapom) which are
our ancestors in our modern sense of the
word. The history of their production is
very obscure. The term called "tapest-
ries" develops from different periods through
the 7th, 8th, 9th, 10th, 11th, and 12th centuries and have always been worked in the form
of pattern work, attached to clothing as a border
decoration. These very ancient pieces display
fluorous decorative designs in several colors.

Gothic Tapestries. By the 14th century, incited by the Oriental works of art brought
back by the returning Crusaders, Europe
started an era of industrial art work. Flanders
progressed most rapidly in the art of weaving
tapestries and her "imagery cloth" (drap
imagéz) produced formerly became famous; so much so that the term "arras"
soon became the familiar name for tapestry
and still remains so in some languages. Brus-
ells became the next centre of this industry to
be followed by Bruges and Flanders. From the
last half of the 15th century to the middle of
the 16th century the richness and pure beauty of the "Gothic" weavings produced
have caused the period to be termed the Golden
Age of tapestries; it is frequently referred to
as the "Gothic Renaissance." Arras and Paris
were now vying with each other as the
principal centres of production. Every royal court
and every baron and knight showed en-
thusiasm in acquiring fine tapestry hangings
and to pride the halls of their castles and
palaces. The tapestries produced from 1483 to 1515 are generally considered
by connoisseurs as the greatest achievements of
the weavers' looms known from the point of
pure art. But these beautiful hangings were
not confined to the castles of royalty and nobility, for the wealth merchants acquired
them and displayed them from windows and
balkonies for the admiration of the passing
world. At the time the streets were decorated for various occasions, honor of royal and civic processions and fests.
The lists, at tournaments, were gay with such
tool rich decorations. With the advance of time
we find primitive stiffness in depiction, entailed
with the Byzantine influence and ecclesiastical demands, gradually pass to the soft curves of
naturalistic expression. The great space, for-
merly divided up into numerous scenes by
quaint separating motifs of Gothic columns and
arches, now becomes one of scenes blending
into one another, later to be given over to one
main scenic picture. The backgrounds in the
early Gothic weaves were occupied by
dense masses of plant life (an Oriental decora-
tive method, doubtless acquired through the
Crusades) and known to us as "verderas" pass
to landscapes and castles lacking in perspec-
tive. These verderas are known to the au-
tormer and his catalogue as "mille-fleurs" or
account of the many little blossoms peeping
out from the branches. Another style was called "a personnages" crowd in the
background with persons streaming from
hills, churches, palaces. Belonging to this early
period of unmodified art we find such talanted
artists as Nicolas (or Colin) Bataille, the
Parisian. In the 14th century France and Flanders: Jacques Dourdin, who worked under the Duke of Burgundy.
tapestry designer was Jan van Room de Rome) in a Gothic-Renaissance style. Figure-decorated pieces are known as

riatted. The decadence of the tapestries sets in with the 16th century; the now attempts to imitate the painted can-

weave in wool to simulate brush workments. To get this strictly artificial effect w simple woolen dyes have to be multi-

into innumerable hundreds of color tones shades. The genius of a Raphael is called slay to design (1513) the "Acts of the es" set of cartoons for tapestries to the Sistine Chapel at Rome. In about 1517, Peter van Aelst, at Brussels, had luced the great work into color in the "They cost Pope Leo over $130,000, in

of that date. This ended the purd of tapestry treatment in the Flemish s and Renaissance painting in wool takes use of Gothic, for the weavers of Brussels ther northern centers now got cartoons from the Paris Cathedral of Notre Dame, Andrea del Giulio Romano and other Italian artists ow out on their looms. The "Acts of the es" designs were later reproduced in European centres. Wilhelm de Fanne-

was noted for his work in this period tyle, as were the Pannemaker family. The enormously increased demand the s grew vastly in numbers and we have s in Brussels, Arras, Tournai, Bruges, en. Oudenarde, Middlebourg, Lille, Ant-

and Delft. As might be expected with a ug demand much greater than the supply, and deterioration set in from careless ion. Low warp (basse lises) were l Rubens was making cartoons for the lands now.

lian Tapestry Factories.—Already in ohannes Thomae de Francia (French) managing, at Mantua, an atelier for the ga family. Succeeding him came Nicolai, te, Adamante (all French). And Flemings employed about 1450 (Rinaldo Boterm of Is, and one Rubichetto). Giovanni del fì and Andre Mantegna did cartoons. nice looms were started by John of i. talfalda and also by Andre Mantegna. m set up looms also in Siena. Renault incourt (about 1455) did "The Creation World" for Pope Nicholas V. In 1441 a had looms worked by the Flemings di Andrea and Giacomo de Angelo; Nicolai and John Racker worked there. Lucas Cornelisz the designer. Rost and ther Flemings arrived, a school was i and a local artist, Battista Dosso, de-

"Life of Hercules," "Scenes from orphs" for other beautiful work. pieces of this school are (in Ferrara ral) "Story of Saint George and Saint lius" and (in Como Cathedral) "Story Virgin." In Florence the Medici estab-

lished an atelier called "Artezzaria Medicea 1737), under Karcher and later Johan Stralen was director about 1570 and olific work. Many pieces are in the ce Tapestry Museum, including the Kar-

ad Rost best productions "The Story of s 1700" and "The Cartoons designed opo Sansovino, Bacchiacca and others. weavers (17th century) were Papini, Van Asselt, Lefèvre, Pollastreri, the two Tumini, Van Bartoli, Manzi, Cavalieri, Buonaroti, Rome, Cardinal Barbarini (1633) established an atelier with Jean François Romanelli as art director, Giacomo della Riviera director of works, M. Wauters (of Flanders) was a creator. "Scenes from the Life of Christ," in 11 pieces, in the Cathedral of Saint John the Divine, New York, are from this factory. In the Hospitale Saint Michele, Rome, Pope Clement XI started (1710) an atelier with Jean Simonet of Paris manager, and A. Procacci art director. Perioli was manager from 1717 to 1770. In Naples (1737), the Florence Medici factory having closed, its weavers started here and ran till 1799. Under Benedetto da Milano the Vignevo works started (16th century) and produced the "Trieste Months" for Marshal Triuise, now in this family's Milan palace.

German Factories.—Otto-Heinrich had an atelier at Launing in the 16th century. Peter Candid designed and Hans van de Biest wove (17th century) "The Four Seasons" and "Day and "Night" six pieces for the Museum in Munich.

French Factories.—François Premier, after his Italian campaign, started an atelier (about 1535) at Fontainebleau. The "History of Diana," was done in honor of Diana of Poi-

liers. Under his son (Henri III) it became de-

 funct; but (1551) Henri opened an atelier at the orphan asylum, La Trinité, employing the children on the work. The "History of Manosolus and Artemisia" (15 pieces) were made here by Maurice du Bourg, its chief, from the designs of Larembert and Caron. Other factories have reproduced it. Henri IV started both high and low warp looms in 1597 in faubourg Saint Antoine ateliers, under du Bourg and Daurent; and, about 1601, Flemish artisans were invited to Paris. Frans van den Planken came from Oudenarde and Marc de Coomans from Brussels and started an atelier in Paris with branches in Tours and Amiens. Henri IV decided to accelerate the industry still more by installing du Bourg and Laube in the Louvre and de la Planche (van den Planken) with Coomans in Les Tournelles palace. The latter works was moved to faubourg Saint Marceau, Paris. Louis XIV patronized the industry. Piere Lefèvre and his son Jean (Florence weavers) came to Paris in 1647. The high warp looms of Tours got Cardinal Richelieu's patronage. Rheims, under direction of Daniel Peppersack, produced "The Story of Christ" and other works. Fouquet of Vaux-le-Ménil started an atelier (1658) on his estate and Le Brun drew cartoons for it ("The Hunt of Meleager"); Louis Blammaert directed the Flemish weavers. When Fouquet, as successor of Mazarin, fell in disgrace, the Maincy factory was closed, after only three years operation.

Beauvais Tapestry. —Minister Colbert (1664) persuaded Louis Hinet, owner of Flanders ateliers, to move his looms to Beauvais under such attractions as a subsidy, the presence of Court orders, and 30 years' a-

college. Hinet was bankrupt by 1684 and was succeeded by Philipe Behagle, who started making full-sized figure pieces. High and low warp looms were operated, but the large pieces showed very little demand. Behagle started a school of design under management of M. Pape and many of the small pieces (low warp),
of great beauty, for furniture, came from designs of this class. On Behagel's death his sons failed and the brothers Filleul took over the business only to fail likewise. In 1722 the atelier was run by Sieur de Mérou, who engaged Jean-Baptiste Oudry (from the Gobelins). Oudry's genius in designing cartoons and management made Beauvais noted. Perfect workmanship marks this period; verdures are delightful, cute ducks, pheasants, foxes, dogs, are featured. Charles Natoire (from the Gobelins) used his talent on furniture. Mérou's financial losses brought Nicholas Benisier as successor. Noted designers of Beauvais pieces are François Boucher, Leprince, Casanova, etc. Low warp pieces predominate. Benisier's death in 1753, followed by the death of Oudry two years later, injured art values of future Beauvais pieces although, under the auspices of André-Charlemagne Charron (1753-1780), the factory was quite a success. From 1780 Sieur de Mérou (from Aubusson) was director, and introduced the use of napier and tapestry weave. The Revolution injured the industry and for one year it was closed but the factory has been kept running ever since. Among extant Beauvais pieces are "Conquests of the East" (two pieces only) in Florence; Raphael's "Acts of the Apostles" (eight pieces), one set in Beauvais Cathedral, another in the French National Collection; "Adventures of Telemachus" (six pieces) in the Royal Spanish Collection, several in Paris; "Bibles du Château" of Sweden (four pieces) in the Royal Swedish Collection. Oudry's "Fables de La Fontaine" designs for chairs gained great popularity and were reproduced prolifically. In the archbishop's palace at Aix-en-Provence are a set of Natoire's "Don Quixote" (10 pieces). Quite a large number of Boucher's pieces are in the United States.

**Aubusson Tapestry.**—The origin of this factory is in doubt, but the Duches of Valentinois' will (dated 1507) mentions the "tapissiers de Feltelin" and Feltelin is a town near Aubusson. Henry IV (late 16th century) lent the Feltelin and Aubusson ateliers assistance by forbidding Flemish tapestry imports. Savary's "Dictionnaire du Commerce" (1641) says: "There are also two other French tapestry factories, one at Aubusson in Auvergne, and the other at Feltelin in La Marche." In 1637 Aubusson had about 2,000 operatives, but both material and designs were of a low order as well as the dyes, and weavers were leaving. Colbert promised a talented artist and an expert dyer. But they never came. The king permitted the use of the title "Royal Manufacture" and promised a good painter, who did not appear. Financial conditions at the Court were bad. However, the factory continued. But in 1685 the revocation of the Edict of Nantes set the best weavers in flight, for they were Protestants, much to the injury of the factory. Louis XV in 1731 sent the efficient dyer (Sieur Fizameau from the Gobelins) and the promised painter (Jean-Joseph Dumons). Dumons' designs were a success. Fizameau was succeeded by Jean-Philippe Montenier. An ordinance of 1732 enforced the weaving of the initials of the town and weaver into the blue border. The Revolution closed the factory, but ever since it has been running with success. Aubusson looms are all low warp. The product is furniture tapestry.

**Savonnerie Tapestry.**—The textile produced at this factory is not what is known generally under the name of tapestry because it has a very different material which originated in the East and had been called "tongue laine" (long wool) or "la façon Perse," also after the fashion of the Persians. Pierre Dupont and Simon Lourdert started for this work in 1657 in the Louvre with a license to weave carpets in the style of Oriental, with gold and silver. The plant moved in 1631 to the old soap works (bourdonnerie) at Châtillon. Louis XIV purchased (1712) the works to assume the title of savonnerie royale des Meubles de la Cour des Tapis façon de Perser et du Le. They gained the same privileges as the Gobelins. The king and his successors, L.VI, VII, VIII, patronized the industry and gave it extensive orders. While the process was knotted work cut to pile, it has ever been as tapestry. Much of the product has been used on furniture as upholstery, looking like a carpet, cloth, or brocaded material. Design-branched foliage and architectural motifs are medallions or other centres.

Other French factories were at Fontainebleau; a tapestry atelier was here (about 1535) by François Première. Philibert Babou as manager and Serlio (Italian architect) as art director. Primatice drew the cartoons. It was discontinued as unprofitable while under the direction of Philibert Delorme during the reign of Henry II. A factory was opened by Raphael de la Planche (son of Frans van den Plancken) at rue de la Chaise, faubourg Saint Germain, Paris, on the death of his father. An atelier at Vaux (17th century) had the honor of having to work on the "Story of Constantine" and "Hunts of Meleager" designed for it by Lebrun, director of the Gobelins.

**English Tapestries.**—An existing piece of tapestry containing the coat-of-arms of the first Earl of Pembroke proves that the industry was established here already in the 16th century. It was woven by Richard Hyckes at Barcheston, who had another atelier at Wissingham. There are two tapestry maps from this weaver's hands in the Oxford Bodleian Library. The Sheldon family continued the work in the next century. William Benod (1670) had an atelier at Lambeth, London, of whose work Haddon Hall holds the "Vulcan and Venus" set (four pieces). Glenham Hall owns four "Indo-Chinese" pieces from the loom of John Vanderbank (end of 17th century), "manager of the King's Wardrobe," who also produced "The Elements" (three pieces) at Burley House; his atelier was in Great Queen street, Soho, London. Early in the 18th century Stephen Demay wove the "Hero and Leander" panels and "Acts of the Apostles," still extant, and Peter Parisot, in the same period, had an atelier at Fulham, London. The name Bradford is woven in a sofa covering of this century at Belton House.

**Morriss de Kent.**—Pierre James I smuggled into England 50 expert Flemish weavers and established, in 1619, a tapestry factory at Mortlake. Sir Francis Crane was the instigator of the movement. Orphans from the "Foundling"
1 Gothic Tapestry (15th Century)
2 "Flora" — Flemish Tapestry (17th Century)
3 "Summer," American Tapestry from the Baumgarten Ateliers
4 Flemish Verdure (17th Century)

(By courtesy of Wm. Baumgarten & Co.)
were apprenticed under the superin-
tendence of Philip de Maecht, a Fleming. His sons were marked P. D. M. often. De-
ree done by Francis Klein (or Cleyne) in 1699. The king's promised financial assis-
tance was not forthcoming and Sir Francis sank all his capital, made an appeal for money to pay overdue wages to weavers. The Prince of Wales gave some assistance and obtained some funds for the enterprise. On the king's death (1702) his heir, Charles I, aided further (as when and Crane was repaid his cash losses in 1690, while the factory became a success. England produced the finest tapestry work (it was always in demand in Flanders and France), and the Italian art designs and Flemish ornamental style, for 10 years, brought forth the finest tapestry pieces the world ever saw. Sir Richard Crane, on the founder's death in 1705, carried on the weaver's successful business and the beheading of the king injured it and quantity of the work. Sir Gillingham, under the Commonwealth, headed the factory. A Hampton Court Mantle depicting the labors of Thebes with two heads, cheaper and poorer tapestries from Italy and the Netherlands were more popular for the war-impoveryed people, however, and the factory closed in 1703. Mortlake repor-
taphael's great "Acts of the Apostles" order designs by Van Dyck; Rubens' of Achilles in six pieces; Cleyen's of Vulcan and "History of Hero and Leander". "Vulcan's Complaint to Jupiter" is an heric collection (loaned to the Metro-
Museum of Art, New York); the Royal collection owns "Hero and Leander" (five pieces); "Vulcan and Venus" in the French National Collection and Vichy; "Naval Battle of Soleby" (three is in Hampton Court; three sets of "Acts of the Apostles" are in the collection.

In 1881 William Morris founded The Gothic Works, "The Goose Girl" from a German cartoon, being the first produc-
tion (12 pieces) is in Cluny Museum. Among the best known Merton pieces are the Holy Grail (in St. Michael's, "The Seasons" (Victoria and Albert); "Star of Bethlehem" (in Oxford); "Gothic Looms.—The Santa Barbara (Mad-
sider opened, in 1720, under patronage of V, with the Jacques Vanderhogen from the Baroque, as experts. Some of the 12th century 92 pieces, woven from 45 of Francisco de Goya, are in Escorial others in the Prado. The factory is operation.

in Looms.—In 1716 the Imperial Works was founded by Peter the Great with Behac and Beauvais operators as the prime weavers. These Tapestries are of very delicate design, but very rare, hence few copies are known. Beauvais Looms.—William Baumgarten, started some tapestry looms at 321 Fifth avenue, New York City, with M. Fous-
dier as manager. After several pieces had been finished (one in the Field Columbian Museum, Chicago), the industry was moved to Williams-
bridge, a suburb, and more weavers from Aubusson, were engaged. A $20,000 set of wall panels and furniture coverings (after Boucher) was produced for P. A. B. Widener of Phila-
delphia. It took 13 months to execute. Next were some wall panels in the directors' room of the New York Life Insurance Company. Beautiful work has been done for such patrons as Mrs. Sheperd of Scarborough, Jacob H. Schiff, Charles M. Schwab, J. B. Ford, D. G. Reid, etc. Here also are produced floor pieces in Aubusson pile style.

Extant Masterpieces.—Of Gothic verdure we have in America (Metropolitan Museum, New York and elsewhere) "Baillée des Roses"; "Capture of Jerusalem by Titus"; Cluny Museum has "Lady of the Unicorn"; Victoria and Albert Museum (London) has the "Four Combatting Scenes"; before the World War Rheims Cathedral had "Coronation of Clovis"; "Capture of Soissons," "Story of the Wonderful Stag," "Victory over Gondebout," etc. Of Gothic tapestries dating from the 15th century, there are in the Cathedral at Angers a set of seven "Apocalypse"; in the Brussels Museum were "Four Philosophers," "Abraham and Isaac," "Presentation of Infant Jesus in the Temple"; in Halberstadt Cathedral, "Christ and Apostles"; pieces (fragments) from the Saint Gereon Church, Cologne, are in museums at London, Lyons, Nuremberg. Arras productions of this period, known and identical, had become reduced to a single set before the war; the "Story of Saint Piut and Saint Eligius" in Tournay Cathedral. Late Gothic examples are in the Louvre, "Last Judgment," "Combat of the Vices and the Virtues," "Creation," "Triumph of Christ," "Christ Inspiring Faith," "Scenes" from New Testament, "Creation," two David tapestries in Brussels Museum; "Story of David" in Cluny Museum. Transition Gothic-Renaissance pieces extant: in Rheims were "Story of Saint Remi," "Story of the Virgin"; "Story of Saint Stephen" (nine scenes); "Last Supper" (10 scenes) in Aix-en-Provence Cathedral; "Life of Christ" in La Chaise-Dieu (both latter 14 pieces). All are without borders. Renaissance pieces are "Acts of the Apostles" in 10 pieces in Beauvais Cathedral, French National Collection, Hampt-

Tapestry Characteristics.—In identifying the location of the weave special attention is given to the border, because special borders were designed for replicas of the original pieces. The tape border or binding, known as the "gal-
loon," often contains the marks of the weavers, but they are often absent. The primitive design is characteristic of Gothic tapestry, such as the Byzantine "stiffness" of expression and "flattening" in clothing, the "fatness" or absence of what artists term "atmosphere," the lack of perspec-
tive. Early works (14th and 15th centuries) usually have but a single subject, few personages. Pointed Gothic architecture in the piece places its period, as do the capitals and shafts of columns. Of course, Renaissance tapestries display florid columns. The earliest pieces have no border—these early ones have simple flowers filling spaces. To find one borders is of great assistance; when armor appears the style affords a good clue. Much may be proven by the makeup of the lettering. Renaissance pieces are devoted to classic subjects, battle scenes, kings, queens and their courts. Borders are a clue; earliest were of woven tape (gallloon) in a single tone. Then came frames of fruit, flowers, foliage (also ribbons sometimes), they are Gothic. Next we arrive at scenes depicted in square divisions, they are Renaissance. The relative value of the border keeps growing as well as the size, and, by the 18th century, we have the central subject actually crowded for space to make room for the elaborated border subjects. In Louis XV tapestries we arrive at actual gold picture frames in textile, moldings and all.

Tapestry Marks.—The first producers’ marks appeared in 1528, when Brussels passed the ordinance by which each piece had to have the town mark, *a heraldic shield between two B’s* in either capitals or minuscules. The two B’s either face the same way or, sometimes, the left B is depicted backwards. It appears on the galloon and generally in a lighter tone than the body. There was also the merchant’s mark. This law only affected those pieces of about 13 feet or over, not the small ones (which were few in early days). In the pieces from the Spanish ateliers of Wilhelm de Panemaker his W P is found in several confusing combinations, and the number 4 frequently is found combined with the W. The initials JG are said to be the forename mark of Jacques Guthe. The Bruges ateliers used two B’s traversed by a crown. A gonronne of four in a shield or circle was the mark of Pierre of Enghien. In the 17th century we find initials (frequently, as two C’s intertwined for Charles Coomans) and C. monogram for Alexander Coomans; J. F. for Jean Lefêvre; P with a fleur-de-lis stood for Paris. A fowl roasting on a spit was the Jean Rost sign; Florence used a lily; Mortlake a shield with a cross entire; Tournay a castellated tower; Lille a peculiar shield charged with a lizard and side initials L and F; Amiens used a double S entwined; Beauvais a red heart, white pale and two B’s; Munich a shield charged with a child standing with arms outstretched on white background (field).


CLEMENT W. COLIN

TAPESTRIES, Manufacture of. A rect history of tapestries has been written by many European and by a very American savants. The rise and fall of merous ateliers and of tapestry-weaving have been traced, quantities of marks and ograms deciphered, long lists of names discovered and the technical processes of weaving at the different eras defined, but the general history of these art products remains great extent unwritten. In evidence of the interesting results research in this field may unfold, the arguments of a learned Frenchman in an essay which appeared some years almost tempt one to believe that the tapestries woven by Helen and Andromache, to represent the principal episodes in the siege of Troy actually inspired the 'Iliad' and the 'Odys.' We have become fairly well acquainted with the social position tapestries occupied in different nations since the dawn of civilization, by the impressions they made upon the public taste from age to age and by reading the history of the roles they filled on hundreds of occasions of pomp and ceremony during succeeding centuries. We have also been fairly well acquainted with the changes in the style and character from the infancy to the maturity of the art, and we are fairly well acquainted with the ideas they expressed throughout this period, by patient research among documents from the great centres of production, by the inventories of princes and potentiates and from newly discovered correspondence. Concerning individual ateliers the facts which had been long forgotten, but which may be known to all by careful study of the existing sources wherever they can be found. Gueffey, Pinchart and Wauters have long since shown that tapestries often exhibit the most loftyest conceptions of many of the greater artists, that at all epochs the most eminent designed models for them, and that with an insufficiency of the existing records of whole schools of production, which they would have been lost to the world if it had not been for the additional action of the characteristics and manner in which the ideas and sentiments of the artists, which they created, and, therefore,
possible to separate the history of paint-
that of storied tapestries.

Tapestries, or calling them by the French name — "Arras" — are decorative or designs in tissue which are made by weaving variously colored wool threads dyed or woven in an entirely different manner. The entire design is made up of different threads with the aid of a loom. This interweaving is done with a "broom" in French, which is a shuttle nor a bobbin, but partakes of the nature of both, and for which there is no equivalent word in English. The picture is developed upon the warp by the color of the wool threads. Needles are used in weaving tapestries. In the case of weaving the wool becomes practically integral portion of the completed structure. Art tapestries can only be woven by artists who, in the best periods of the ages, interpreted and never copied a thing. Their work cannot be altered nor imitated, but naturally was affected by those who saw other things in different qualities of fabrics; since they have not each piece possesses a distinct origin and is not a mechanical repetition of the subject; and since every thread of the web is incised by those laws that the warp is invisible on either side of the tapestry. The kind of tapisserie and machine-woven which masquerade under the same name, people who can work such skill that the distinguishing from fabrics; since they have no use each piece possesses a distinct origin and is not a mechanical repetition of the subject; and since every thread of the web is incised by those laws that the warp is invisible on either side of the tapestry. The kind of tapisserie and machine-woven which masquerade under the same name, people who can work such skill that the distinguishing from fabrics; since they have no use each piece possesses a distinct origin and is not a mechanical repetition of the subject; and since every thread of the web is incised by those laws that the warp is invisible on either side of the tapestry. At Gobelins they weave only in haute-
1d at Beauvais, Aubusson and Moline, basse-lisse. In both kinds the warp is stretched on rollers so that they keep taut and parallel like the strings of a harp, but naturally work in an entirely different manner. As there are usually 22 to 26 of them. In the process of weaving both sorts hang in loops or in which the threads are different tones of color. In haute-lisse one end is attached to another warp in each relay, at a slight distance above the other end. Assistance of these strings called "lisses" imparts the warp threads backward and from right to left between as many or of them as he desires with his right hand. In basse-lisse these threads are attached to mechanical contrivances to pedals at the loom so that the weaver raises and lowers the threads with his feet, and both hands free to pass the broche, he has about one-third faster than the weaver in haute-lisse.

Frugality and Cost of Weaving.—The number of warp threads which are covered by the warps of the broche and one thread of the reel only as many as are included in a shade or tone of color. In background scenes and skies the woof-thread may cover at each pass from 30 to 60 warp threads, but when personages or their costumes are represented it rarely covers more than two or three of them. In short, it is the manifold changes in the coloring, lights and shadows, the half-tones, and so on, by which the artist can weave only about a yard square in a year. At the Gobelins, to-day, this yard square costs about $800, which does not include taxes, insurance, interest on cost of plant, rental for the apartments of the weavers, etc. The weaver passes from light to dark colors and from one shade or tone to another by weaving in threads of intermediate shades or tones in formations like the teeth of a comb and thus avoids the mosaic effect which would follow weaving in different threads. This is not done by side. This process is termed hatching the colors, and is one of the most difficult feats in tapestry weaving. In valuable antique tapestries the colors are usually hatched with colored bars or with parallel lines. The eye does not readily discover where the different shades of the same color begin or end.

Difficulties of Weaving.—In both haute and basse-lisse the weaver works on the wrong side and the finished part faces away from the loom. Consequently he is unable to criticize the progress of his work unless he walks around to the front of his loom in haute-lisse, and unless he raises it from its horizontal position in basse-lisse. In haute-lisse the cartoon is placed behind the weaver, and in basse-lisse it is placed beneath the warp. The weaver in haute-lisse translates the cartoon by sight, with nothing to direct his eye but the outlines of it that he has traced upon the warp, but he can, by walking round to the front of the tapestry, or by the aid of a mirror while seated take constant note of his work, and even make slight modifications in it. The weaver in basse-lisse, seeing but imperfectly what he translates, as the warp threads hide the cartoon to a certain extent, cannot examine his work, except at considerable trouble, until the tapestry is finished, when it is too late to remedy any defects. Naturally, therefore, the artist in haute-lisse has greater opportunities for noticing the effect of light and shadow and can more readily interpret or idealize the cartoons according to his own conceptions than can his brother in basse-lisse. For these reasons haute-lisse tapestries possess as a rule greater artistic value than basse-lisse. It may be said in a few words that haute-lisse are mostly creations from, and basse-lisse are mostly reproductions of, their respective cartoons.

The precautions taken by the weaver to verify the correctness and excellence of his work are, however, of little advantage if he does not possess the specially developed talents as well as the necessary skill and experience to insure success in his interpretations. He uses dry and supple materials which cannot be manipulated as readily as the semi-liquid colors of the painter, nor can the thickness of
these materials be increased or diminished at will as can paints upon canvas. He cannot correct nor alter, nor even materially modify what he has done, nor erase and begin again, as the painter. He cannot varnish his production, nor employ any other of the multiplied accessories of the brush and the palette. His work grows almost imperceptibly and he is, therefore, unable to seize the general effect of the entire composition in any other way than mentally. He cannot obtain transparency and harmony except by the complicated process of hatching the colors, and must be exact in choosing them and measurably correct in his drawing, although working grace on the wing side. He can improve slight faults by packing the wool threads more or less closely together with a special kind of comb, but he cannot change faults in color or in drawing except by unweaving the defective part and renewing it thought. Is it any wonder that it takes at least 12 to 15 years to educate a novice in all the mysteries of the profession and that it took several generations of master-weavers to perfect the art of weaving storted tapestries? The tapestry that is woven from a basse-lisse tapestry, and the amateur even is often at fault unless there should be a manifest defect visible, like a mark, monogram or inscription running backward. Since the cartoon in basse-lisse is placed beneath the warp, it is the finished tapestry, and its subject is, therefore, reversed in the process of weaving, just as your signature or any other bit of writing is reversed on the blotting pad with which you dry it. No marks, monograms or inscriptions were usually painted upon the cartoon, consequently the weaver, after completing the design, took of some of them in as he would write them, which naturally made them run backward in the finished tapestry. In basse and haute-lisse interpretations of the same cartoon, the subject faces the spectator in the former in an opposite direction from which it faces him in the latter. To avoid this difference it has been usual for a long time to furnish the basse-lisse weaver with a reversed model of the cartoon so that the scheme of the tapestry when finished was reversed. It is the practice to divide the cartoon at will. Any one can, however, occasionally detect a basse-lisse tapestry on closely scrutinizing it with a microscope on the wrong side, by finding here and there the hairs from a man's beard. This may seem ludicrous, but the ancient basse-lisse weaver, according to existing illustrations, usually wore a full beard, and when he bent over his work to catch glimpses of the cartoon beneath the warp, he occasionally caught a hair or two of it between the threads of the warp and the wool. There are a number of embroideries mis-called tapestries, notably the historical Bayeux frieze which many authorities assert was made by Queen Matilda of Normandy, and her maids of honor, although there are many others which serve to reproduce it with. It is needlework, and in no sense a tapestry.

History of Weaving. The art of weaving tapestries was understood in the remotest ages, and was discovered but little later than the art of painting. Weakening and diluting with the spirit of decoration manifested itself almost everywhere long before the dawn of civilization. It is a long way from the coarse and creampile used in ancient times by many ing tribes in the decoration of their sumptuous abodes. It was versely employed by the rich and noble, 15th, 16th and 17th centuries to enhance splendor of their palaces; nevertheless the student will find ample opportunity for thought and gratification in every elucidates the progressive steps in the long march. In short he will find a study of tapestries will lead him into which were practically closed for 100 years that it will open his eyes to new views of the race. Not the mere excursion into this field, the most ancient visible evidence of manner of weaving tapestries, but the art upon the walls of the hypogeum of Beryan el-Gadin of a painting finished about years before the birth of Christ, upsetting various calculations, since it represents two sons weaving at a loom very similar in respects to those of the olden time. There is a tradition among the Hebrews that the art was invented by the daughter of but some of the ancient philosophers and of the ancient poets claim that the hortel to Phanphil, daughter of Apollo, though Pliny the younger in his graphic tells that the sumptuous beauty of the industrial andactive products of his era yet he is unfort silent upon the manner in which they woven, and the probable inventors of them. Ovid, on the contrary, is definite and explicit and not only gives the origin of the art, in his description of the Lydian maiden and the goddess Ariadne, but judging by his psychological process, one could well believe he describes the manner with which the work is woven at the Gobelin's to-day. Accord the story Arachne was exceedingly vain dexterity in weaving and challenged him to a trial of skill. The outraged goddess accepted, but wove no better than the sumptuous damsel. Each attached the beam and passed the slender broches out among the threads. Minerva who scenes of her contests with Neptu Arachne the love exploits of Jupiter goddless could not forbear admiring the work of the maiden, although enraged mortal should have dared to compete immortal. In her anger she destroy tapestry of Arachne, struck the damsel forehead with her broche, metamorphose into a spider, and lady her weave on f

Oldest Tapestries. The oldest mural tapestries are no doubt the frescoes from the Church of Saint Gereon in Bologna, which were woven in Europe in the 12th century. The oldest tapestries are no doubt those discovered in Crimu by Stephan, thearcheologist, who believes they were woven in Asia 400 years before the Christian era. The oldest I have ever seen are of cloth of gold, and were found in tombs of ancient Egyptians. They were in haute-lisse and are presumed to
The 9th centuries. Coptic tapestries, in so far as known, in decorating houses there is no evidence that any of them were used as ornament houses. In consequence, the most valuable and important collections of storied tapestries are those in Paris, Madrid, Florence and Vienna. In each collection, except the last named, there are about 600 pieces. That in Paris is largely composed of tapestries woven in Flanders and is unrivaled in its magnificent specimens of Gobelins and Beauvais manufacture. That in Madrid is largely composed of those woven in Flanders, and is remarkable for its wealth of superb Flemish specimens. That in Vienna is not as large as those in Florence, Paris or Madrid, but includes tapestries woven in all the great centres of production, although, as in Madrid, those woven in Flanders are in the majority. That in Florence is composed of nearer equal proportions of the products of France and Flanders than any of the rest, although the Italians claim that almost one-third of it was woven in Italy.

Flemish Art.—The work of the Flemish weavers, studied in its entirety, constitutes an immense epic in warp and woof, illustrating religious and profane history, mythological episodes, legends of the saints, creations of the poets and novelists and celebrated acts of great men of all ages. Her master-weavers, however, did not confine themselves to these inexhaustible sources, but made admirable representations of nature's models, for, the truthfulness of their landscapes, the repose, softness and veracity of their background scenes, and the purity and reality of their garlands of flowers and fruits have received the unbounded admiration of connoisseurs for generations. Some of the historians of tapestries have failed to award Flanders her just rank as the greatest of all centres of tapestry weaving. For over three centuries she eclipsed all others in the magnificence and excellence of her products and in future ages when the tapestries of the latter part of the 18th and all of the 19th century have passed into oblivion, amateur and connoisseur will still recall the glory of her ateliers and still go into raptures over the tapestries which issued from them during the 15th, 16th and 17th centuries. During these 300 years she led the world in the production of practically perfect examples of textile painting, that is, tapestries which are rich in color, strong in decorative effect, graceful in drawing and with subjects adapted to the exigencies of the loom and the aesthetic requirements of wall decorations. Her tapestries of the first half of this period rarely contain more than 30 to 50 different tones and shades of color, the half tints and graduations having been made by patching one color into another. In the 16th century Flemish tapestries reached their apogee. Her master-weavers, from their profound love of their art, wove as if inspired and painted both grandly and broadly in tissue. By careful and intelligent study they absorbed and interpreted even the mores of those to which the artist would apply. From ancient art they designed the models and “often further idealized the latter's ideals.” Naturally, therefore, the productions of Flanders outvalued those of any other part of Europe, but about the middle of the 17th century she was obliged

Museums.—There are only two Europe devoted exclusively to the tapestries and textile products, to Gobelins in Paris, and the Croceta in Milan. Although some of the remarkable collections, their tapestries exhibited in the royal or lace, or in the museums among the collection of art. Those exposed at the have been selected with especial care piece shall be an object lesson to the student, enable him to distinguish the modifications in the methods of weaving at different epochs, criticize the results, and become acquainted with the changes from the first foundation of the Gobelin in 1663 to the present day.
to bow her proud head to her rival—Paris. As the taste and demand for tapestries grew, most of the sovereigns of Europe determined to establish ateliers for weaving them in their respective territories, but nearly all were obliged to depend upon Flanders for master-weavers capable of carrying their resolutions into effect. France was the only exception of any note, for the art of weaving tapestries had been introduced in that country at probably the same period as in Flanders. Although the French ateliers had endured all through the long years of her wars with England, yet the best of them had not succumbed. Under the fostering succor of Francis I and Henry II they showed renewed signs of life; under the wise policy of Henry IV and Louis XIII they gathered additional strength, and under the magnificent support of Louis XIV they out-rivalled all competitors. Nevertheless Henry IV summoned celebrated Flemish master-weavers to France, loaded them with honors and showered inestimable privileges upon them, which Louis XIII and Louis XIV gladly continued and extended. The object of the French kings was to increase the demand for tapestries by introducing cheaper methods of weaving then known in Flanders, as the lessened cost would bring them within the reach of the middle classes, whereas they had heretofore been found purchasers only among the rich and the great. Finally, as these kings expected, French ideas and taste prevailed and the ateliers of France grew in importance and reputation as the character and prestige of those of Flanders faded away, until all the latter were closed, leaving the field entirely to their French competitors. See Tapestries; Gorellin, etc.

Charles M. Foulke,
Lecturer and Writer on Antique Art Tapestries.

**TAPEWORM.** An elongate flattened ribbon-like parasitic worm belonging to the class Cestoda (q.v.) of the phylum Plathelminthes. In the large majority of forms the body is divided into units, segments or proglottids which are usually conspicuous externally although in a few less common genera such partitions are lacking and there are rare species in which the body consists of but a single joint or section. The tapeworms are common in all vertebrates and from their considerable size and length are the most conspicuous of all parasites. Three of the 24 species found in man are 10 meters or more in length and yet certain other species are so insignificant that they have long been overlooked. The large human tapeworms were known to the Greek and Egyptian physicians although all were regarded as of one kind and it was 1002 before the famous Basel clinician, Felix Platter, distinguished two kinds of tapeworms from man. The large bladderworms from various domestic animals were also well known to Greek writers on medicine but were considered as growths until Redi in Italy demonstrated their animal nature. They were, however, placed in a special class (Cyestia) until about 1850 Kuchenmeister by feeding experiments established their relation as larval or immature forms of certain tapeworms. The prescription placed by Moses on the use of certain flesh had its ground unquestionably in the prevalence in such animals of bladder-worms. Hippocrates writes of evacuation of pumpkin-seed-like forms diagnostic of tapeworm and Aristotle in contrast with round worms the tapeworm is attached to the alimentary canal by means of its scolex. The body of a tapeworm has at a bulbus enlargement known as the scolex which in other types has a different structure but is oval with two elongate suckers in the fish tapeworm of man and more rare with four cup-shaped suckers in the pork tapeworms of man. (Cf. Figs. 1: Following the scolex comes a very region usually undivided; this neck: It changes very gradually jointed body which becomes heavier a conspicuously divided toward the lumen where in the full grown intestinal proglottids are being regularly set free: ejected from the intestine of the host, body is highly muscular and has no hair, it varies constantly and con shape, especially at and near the neck so that the entire appearance the posterior portion may be radically modified. (1) The head may be armed with hooks as suckers, as in the human pig, designated the pork tapeworm. Most tapeworms are found in in and in man this is the only normal and the reports of their occurrence in the being purely imaginary or due to re the normal movement of the alimentary They have been found in the bile duct as the scolex embedded in the wall of the time, but all such occurrences are rare and as abnormal. The effect of this parasitism is measured first by the loss of essential which must be relatively great as the large and grows with striking rate the beef tapeworm the size is about 72 millimeters per diem which is about the formation of 13 to 14 proglottids in 24 hours. This factor is, however, inadequate for the results produced by the presence of only a single parasite. These symptoms are prominently of a reflex character and are usually explained on the position that the tapeworms pre
es which are absorbed by the host and a marked toxemia. One human tape-
worm reproduces a severe anemia of the per-
type recognized as characteristic of the
of this species, symptoms of tapeworm disease are
general and not well defined so that a
in successive segments. The large bush-like
masses are ovaries and the slender flattened
structure near the posterior margin is the yolk
gland. Between it and the ovaries lies the
small spherical Mehlis gland formerly known as
the shell gland, but incorrectly designated as
such since investigations show that the material

<table>
<thead>
<tr>
<th>Country</th>
<th>Dates of records</th>
<th>Total number of cases</th>
<th>Tenia saginata</th>
<th>Tenia solium</th>
<th>Dibothiscocephalus</th>
<th>Dipylidium caninum</th>
<th>Hymenolepis diminuta</th>
<th>Indet.</th>
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<td>Milan</td>
<td>1889</td>
<td>150</td>
<td>121</td>
<td>11</td>
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<td>14</td>
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<td>1858-99</td>
<td>513</td>
<td>397</td>
<td>33</td>
<td>26</td>
<td></td>
<td></td>
<td>19</td>
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<tr>
<td>England</td>
<td>1860</td>
<td>100</td>
<td>37</td>
<td>9</td>
<td>9</td>
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<tr>
<td>Denmark</td>
<td>1860-87</td>
<td>200</td>
<td>153</td>
<td>24</td>
<td>16</td>
<td>8</td>
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</tr>
<tr>
<td>Denmark</td>
<td>1887-95</td>
<td>100</td>
<td>89</td>
<td>13</td>
<td>5</td>
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<tr>
<td>United States</td>
<td>1897</td>
<td>Many</td>
<td>Rare</td>
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The abundance and distribution of ns are not accurately known and a data exist only for a few localities : selected groups such as hospital inmates of public institutions and
French maritime hospitals reported in ut 1.5 per cent of all cases were treated worm infections and the United States service during the Civil War recorded 12 per cent treated for tapeworm, a hat is certainly much lower than the ree of infection in this country.
bladder worm, or larval stage in the y of the tape worm, is found encysted flesh of a great variety of hosts. It trance to the final host when the flesh ing the cyst is ingested. When set digestion the bladder-worm everts the d neck region which were formed in fashion on the inside of the hollow l or oval larva. The bladder itself is but the chain of proglottids grows out : neck.
beef tapeworm (*Tenia saginata*), also abe unarmad tapeworm of man because ex is devoid of hooklets, inhabits the testine of man but has not been found other host. The bladder-worm (*Cyrti-
ica*) occurs in the muscles and viscera . As is natural from the cosmopolitan ion of both hosts this parasite occurs : entire world but is more common in gions where the habit prevails of eat: underdone or rare. It is also ince-rf eqency as shown by the statistics of 1ch maritime hospitals which report 33 mong 130,927 or 0.2 per 1,000 during and 1886-90, 2,253 were infected among or nearly 75 times as many as at the late. Attention has already been called read of this tapeworm which with the highly muscular and variable in form. reductive organs are not visible except strands of tissue in full grown pro: they have the form represented in The numerous small round masses are es which communicate by branching with the common sexual pore at the enerally speaking these pores alternate

Fig. 2.—Sexual organs in a tapeworm segment (*Tenia
saginata*).

Fig. 3.—Free proglottids of A, *Tenia solium*, and B, *Tenia saginata*. for the shell comes from the so-called yolk gland or vitellarium. At this stage of development the uterus appears as a median sausage-shaped receptacle. When the eggs accumulate it is increased in size so greatly that numerous lateral branches are formed extending almost to
the margin of the proglottid, giving the aspect shown in Fig. 3.
The segments of this tapeworm when evacuated are little more than sacs covering the much branched uterus which is crowded with eggs. They possess considerable power of independent movement and are frequently found at some distance from the point of deposit. The eggs have several coverings which
serve to protect them even after the disintegration of the proglottid. Distributed by chance an egg reaches the stomach of an ox with the food or drink of a man. Under the stimulus of the gastric juice the membranes are ruptured and spherical six-hooked larva escape. It bores its way through the wall of the alimentary canal and comes to rest in the connective tissue. When it reaches a suitable location it develops by growth and the accumulation of a considerable amount of fluid in the centre to a bladder-worm. A thickening of the wall of the bladder produces an ingrowth in which is formed in reverse the head of the future tapeworm. Growth is slow and in six months the worm measures only six millimeters or less in diameter. If the flesh containing the bladder-worm is consumed by man while the parasite is still living the head of the bladder-worm is everted and it attaches itself to the wall of the intestine and begins to grow into a mature specimen. This period of growth requires no more than 9 or 10 weeks for the production of mature proglottids. Since a moderate temperature is favorable to the bladder-worm in well-cooked meat it cannot possibly carry the infection. Exposure to cold storage conditions for three weeks is also adequate to destroy all the bladder-worms contained in a piece of beef.

The pork tapeworm (Tania solium) is known as the armed tapeworm of man because of the crown of minute hooklets which is found on the anterior face of the scolex. Like the preceding species it is confined in the adult condition to the small intestine of man. Its bladder worm (Cysticercus cellulosae) occurs in the muscles and viscerina ordinarily of the pig from whence the common name of the parasite. It also occurs in the dog, cat, rat, ape and rarely, also, in man. While the distribution of both parasite and bladder-worm is as broad as that of the previous species yet there are certain parts of the world where it is entirely wanting, i.e., among those people who do not eat the flesh of the pig. The species is common in European countries where pork is consumed in the smoked but uncooked condition and is very uncommon in the United States because of the general practice of eating pork well done. The parasite is somewhat more slender than the beef tapeworm. The terminal proglottids (Fig. 3) show that the branches of the uterus are less numerous and heavier than those of that species, but to distinguish between them is not always easy. A positive determination can readily be made when the scolex is obtained because of the presence of hooks in a double circle in which they alternate regularly in size. In general the pork tapeworm is less muscular and more transparent. Its life history is similar except that the eggs find opportunity for hatching and development in the pig rather than in cats. The species is more dangerous than the preceding form because of the fact that the bladder-worm may develop in the human host. Apparently the brain and the eye are the points in which they have been most frequently observed and the cerebral cysticerci are most dangerous because they produce naturally conditions similar to brain tumors and are not infrequently the cause of sudden death. There are no special symptoms connected with presence and usually it is not possible to distinguish between them and tumors of different origin. The bladder-worm displays in situations a marked longevity as the individual has been followed by means of ophthalmoscope for 20 years in the human Because of the campaign against the pork except when well cooked this parasite grown much rarer within recent years.

The dwarf tapeworm (Hymenolepis nana) is the most numerous parasite of this kind found in man in North America. It is recognized as identical with a species that occurs in rats as well as in rats (H. nana). On account of its size it was not discovered until the mid-late last century and while even yet it is frequently overlooked it is present at times in enormous numbers. It may justly be cons slender cosmopolitan in its distribution. Cases in general under unfavorable hygienic conditions and infection is probably traceable to contamination of food by rats and pigs. The worms are usually found in considerable numbers and excite digestive disturbances marked severity. Diagnosis is made by a scopic demonstration of eggs in the treatment should be in the hands of a physician. The records of Ransom concerning American cases indicate the great frequency of the parasite in children and especially infants.

One of the smallest of tapeworms is H. echinococcus which is a parasite of The chain consists of only three or four proglottids. The parasite is important because of the character of its larva or bladder-worm which is known as an echinosomes (Echinococcus polymorphus). This bladder-worm develops in a very large number of hosts and provides a complex structure with secondary and tertiary bladders in great numbers so that the mass assumes enormous proportions. It is one of the most frequent causes of intestinal obstruction because the tissues involved may be fig. 4. Hymenolepis nana: A, Scolex \times 15, B, Female, in extended and contracted conditions. Character to prevent surgical treatment. It was brought about by the use of certain compounds and to the general practice of removing the tapeworm by surgical means other methods of treatment have recently been tried with some success. This and numerous other parasites owe
TAPIOCA — TAPIR

T. Dibothriocephalus latus, known as the fish tapeworm. It occurs in the small intestine of man and other mammals. The larva is found in the flesh of various animals, including dogs, cats, and rabbits. The adult tapeworms live in the human intestine and can cause severe illness.

TAPIR, a member of a family (Tapiridae) of hoofed mammals, allied to the horses and rhinoceroses and chiefly distinguished by the fact that the nose is prolonged to form a short proboscis or trunk and the front feet have each four toes, the hind feet possessing three toes only. The little toes of the front feet are unsymmetrical and do not touch the ground, while all the toes are "hoofed." They are adapted to live in swamps and rarely leave the forests covering such wet places. The tapirs possess a very wide distribution and inhabit both the Old and the New World. The best-known species is the South American tapir (T. terrestris), which inhabits the tropical forests of South America and is chiefly found living on the banks of rivers, in which it swims and dives with great ease. It is chiefly a nocturnal animal, feeding on roots, fruits, and leaves. The adult is colored brown, the young being variegated with lighter spots and stripes on a darker ground. The hair is short and thick, but the neck possesses a short black mane. The average length is from four to six feet. A second species of South American tapir is the T. villosus, which is distinguished chiefly by the greater length of its hair, due to the fact that it inhabits elevated foot-hills of the Andes, where the climate is cold.

The only other distinct species is the Malayan tapir (T. Malayanus or Indicus), found in Malacca and Sumatra and known by the white color of the hinder part of its body, the head and anterior portions being black. The proboscis is larger in the Malayan species than in the South American form, but the former has no mane. It is usually of larger size than the New World forms and appears to be a shy, retiring animal, inhabiting clumps of brushwood.

The existing tapirs seem to approximate more closely than any other perissodactyls to the primitive (Eocene) type of that group. The family, as at present defined, dates back to the Lower Miocene and its remains are found in the White River beds of that age in the Rocky Mountain region. The earliest are separated as the genus Tapiris, but typical tapirs soon appear. "It is thus evident," remarks Woodward, "that during Miocene and Pliocene times these animals ranged over most of the warm and temperate lands of the earth's sphere. Hence is explained the remarkable distribution of the existing tapirs, which are confined to two widely separated areas, namely (1) certain portions of the Indo-Malayan region, and (2) the tropical parts of America. Like the surviving dipnoan fishes they are an illustration of a once dominant race nearly exterminated, but still struggling for existence.
TAPPAN, Tappan, Arthur, American philanthropist: b. Northampton, Mass., 22 May 1786; d. New Haven, Conn., 23 July 1865. He accumulated a fortune in the dry-goods business in New York and became noted for philanthropy. He was a founder of the American Anti-Slavery Society, endowed the Lake Seminary in Cincinnati and aided other educational institutions. In 1828 he founded the New York Journal of Commerce and in 1833 established The Emancipator. He was an ardent abolitionist and a president of the American Anti-Slavery Society, to which at one period he contributed $1,000 a month. He aided fugitive slaves to escape from the country and procured the release of William Lloyd Garrison when the latter was imprisoned in Baltimore, by paying his fine.

TAPPAN, Benjamin, American naval officer: b. New Orleans, La., 10 April 1856. He was graduated from the United States Naval Academy 1876 and in 1886 was commissioned lieutenant. From 1888-91 he served in the office of the Bureau of Naval Intelligence and from 1891-94 on the hospital ship. He was stationed at the Brooklyn navy yard 1895-96 and while on board the Raleigh participated in the battle of Manila (1898). During the attack on the city of Manila he captured a Spanish battery and for this act was advanced five numbers by President McKinley.

TAPPAN, Eva March, American educator and author: b. Blackstone, Mass., 26 Dec. 1854. She was graduated from Vassar College in 1875 and was a Fellow of the University of Pennsylvania. She published 'Charles Lamb, the Man and the Author' (1896); 'In the Days of Alfred the Great' (1900); 'Our Country's Story' (1902); 'In the Days of Queen Victoria' (1903); 'Canada's Story' (1903), etc.

TAPPAN, Lewis, American merchant and philanthropist: b. Northampton, Mass., 23 May 1788; d. Brooklyn, N. Y., 21 June 1873. He spent several years in commercial life at Boston, then (1827) settled in New York as partner of his brother, Arthur. Both took a very active part in the anti-slavery cause. Lewis and his brother were among the founders of the Journal of Commerce (1827) and (1828-31) Lewis was sole proprietor. The pro-slavery mob, in 1834, sacked his residence. He aided in the organization of the American Missionary Association, acting as treasurer and president for a number of years. His firm failed in the crisis of 1837, but later met all indebtedness. After the failure he established the first mercantile agency in this country and remained its head for a number of years. He published his brother Arthur's 'Life' (1871).

TAPPAN BAY, or TAPPAN SEA, the name given to the expansion of the Hudson River near Ossining and Tarrytown, N. Y. See HUSSON RIVER.

TAPPEN, Frederick Dobbs, American financier: b. New York, 29 Jan. 1829; d. Latham, N. Y., 28 Feb. 1910. He was educated at Columbia Grammar School and New York University, graduating in 1849. Next year he entered the National Bank of New York as clerk, rising by 1857, at which time the bank was reorganized (1865) as the National and Tappan became president in 1869. He became member of the conference committee with the New York Clearing House in 1889 and member of the committee in 1877 was appointed (1873) member of a committee to suggest financial reforms in operation between banks. Then and later he wrote about clearing-house reforms in practice and was in the 1893 crisis Tappan rendered important service; by June business paralysed and business corporations, banks, roads, etc., had a $2,000,000,000 liability gold in the treasury at low ebb, but the Clearing-House Association decided the bank could be maintained by extension of credit which was averred. Later he rendered useful service in times of panic.

TAPI, tap'tē, India, a river rising in the Mahadeh, flowing westward into the Gulf of Cutch, is 430 miles long and navigable for a short distance.

TAPUL, tā-pool', a group of islands in the Sulu Archipelago, Philippines, lying off the coast of Luzon. The group is the northeast and of the Tawi-Tawi group on the southwest, consisting of three islands named and some uninhabited; area, 77 square miles. The more important of these islands is the (q.v.), the largest, in the southern part of the group; (2) Bolilong, the most northerly of the group, heavily wooded; elevation 1,344 feet; area, eight square miles; (3) Lapat of Siasi, from which it is separated by a narrow channel, with a very rugged surface; elevation, 1,344 feet; area, seven square miles; (4) Tapul, the name island, the most north of the group, fertile and under cultivation, highest elevation, 1,636 feet; area, six miles. Though all tropical products and motion flourish in the larger islands, the industry is mother-of-pearl, pearl and fishing; there are coconuts plantations of great value, on one of the islands. Trade is carried on by Sulu, Tawi Tawi and Borneo. Pop. (1901) 3,000. See SULU.

TAR, a thick, very dark liquid obtained by the destructive distillation of vegetable substances. That obtained from peat, bituminous shale, etc., is called coal tar, while that from wood is named wood-tar. Both are very complex mixtures of substances. The substance popularly known as tar is wood-tar.

Coal tar is collected from the hydrates and condensers of the gasworks and contains a large amount of carbon, acid and base substances. Its components are first separated in a rough way by distillation and are then fractioned to an extreme chemical treatment to purify each substance therein. Of the various acids, the most valuable are the maleic.
TAR HEEL STATE — TARANTO

re benzene (or benzoil), toluene, xylene thracene. Of the acid bodies phenol or : acid is the most important. The value se substances lies not in themselves but com-bound to which the chemist may from them. Nearly all of the varied and ul dye-stuffs now used are obtained from instances mentioned above. The coal-tar are of exceeding brilliancy, but many king in permanency. (Plat.) Coal-tar is a thick, dark colored, viscous it, obtained as a by-product in the de-re distillation of wood in the manufac-tur pyrolygenous acid (wood vinegar) and alcohol (wood alcohol). It varies some-1 character with the kind of wood used. tar has many ingredients in common coal-tar. The hydrocarbons mentioned are present in small quantities; small s of carbolic acid are found with much quantities of homologous substances, the (the whole mixture being called creo-Products arising from the pyrolygenous id methyl alcohol are also found, such tone, methyl acetate, etc. Wood-tar is id in large quantities in northern Europe ery crude and wasteful process. A hole ground or side hill is lined with turf and lled with wood (usually of coniferous which is afterward nearly covered with The wood is burned slowly with little to 2. The tar collects in the bottom, usually caught in an iron pan provided 3 exit tube. Wood-tar has valuable anti-properties because of the creosote it con-This is often separated, but the wood-sif is much used for coating and pre-timber in exposed places.

is a stimulant and antiseptic to the skin aucous membrane. It is used externally n diseases as an ointment, lotion or soap. oune in many cough mixtures and its is frequently inhaled for pulmonary

A HEEL STATE, a popular nickname to North Carolina (q.v.).

RA, tā-ra, Ireland, a hill in County six miles east of Trim. According to the fes of Tara, the traditional con-here, was established by Olram Fod-Ollay Fola (b.c. 900 or 950). After the is of the meeting the princes and others held a banquet, each guest seated he-shield which the heralds had sus-on the walls of the great hall. The of Tara, tradition says, was 900 feet and had 150 apartments and 150 dormi-The hall had a capacity for entertaining quests daily. It was here the early kings and were crowned. King Cormac Ma-d century A.D.) is said to have founded here of military science, law and litera-In the days of Saint Patrick, Tara is have been the principal seat of Druidism ra and (about 500 A.D.) fell under se of Saint Ruadan and had to be aban-as a royal residence. A battle here is have caused the fall of Danish rule th in 980. In 1798 the Royalist troops, ang, defeated 4,000 Irish insurgents, 56, at Drumore O’Connor. After the city had supported the insurgent re here 15 Aug. 1843, at which it is said persons attended. The so-called re-mains of the royal palace are represented by six raths or circular earthworks, of which the rath-na-riog (king’s rath), which is the most extensive, contains the forradh (meeting place) which consists of an oval level summit. The “stone of destiny,” on which the kings are said to have been crowned, is located here. Certain earthworks enclosing a space about 759 feet by 46 feet and having bases at intervals supported by have been the entrances are considered as having been the banqueting hall. Thomas Moore rendered the Tara tradition imperishable with his poem “The Harp That Once Through Tara’s Halls.”

TARAI, tā-ri, or TERAI, India, a moist, jungly and unhealthfull tract of land running for several hundred miles along the southern base of the central Himalaya. See HIMALAYA.

TARANTELLA, a swift, whirling Italian dance; so-called because it was popularly thought to be a remedy against the supposed poisonous bite of the tarantula spider, which was said to set people dancing.

TARANTISM, or TARANTISMUS, dancing disease (q.v.).

TARANTO, tā-rantō (Latin, Tarentum; Greek, Taras), southern Italy, a for the province of Lecce, at the northern angle of the Gulf of Taranto, on a rocky tongue of land which separates the ancient inner harbor, a sort of lagoon called the Mare Piccolo (Little Sea), on the east, from the open sea on the west. The side has been made an island by a canal on the southeast, crossed by an iron swing-bridge, which admits the largest war vessels; another bridge at the northwest end also connects it with the mainland. Two islands, Saint Paolo, with a fort and a lighthouse, and Saint Pietro, guard the entrance to the outer harbor. The streets are very narrow, the three principal being the Strada Garibaldi along the Mare Piccolo, inhabited chiefly by fishermen; the Strada Maggiore, in the heart of the town, the main business thoroughfare; and the Strada Vittorio Emanuele, along the sea-front, a fine promenade. The 11th century cathedral, now wholly modernized, and the old castle are the chief objects of interest in the town proper. The Borgo Nuovo, a suburb on the mainland to the southeast, occupying the site of ancient Tarentum, contains a large arsenal and naval hospital and various harbor works have been constructed. The fortifications of the town have been much strengthened since 1863. There is an export trade in oil, wine, licorice, fruit; and coals, grain, petroleum, etc., are imported. Tarentum was founded by Greeks in 707 B.C., and rapidly became the chief city of Magna Græcia. It was noted for weaving and for the purple dye obtained from a species of mussel. It reached its greatest prosperity under Archytas, the philosopher, in the 4th century B.C., after which luxury and vice caused it to decline. It was compelled to seek the assistance of Greek kings in its wars with the Lucanians and when attacked by the Romans it was assisted by Pyrrhus of Epirus. In 272 B.C., however, it was taken by the Romans and the conquest was repeated in 209, after the battle of Himara in the Second Punic War. It passed later under Byzantine sway, was destroyed by the Saracens.
TARANTULA — TARBEll

in 927 A.D. and later belonged to the Norman kingdom in South Italy. In 1861 it became included in the kingdom of Italy and the Italian government strongly fortified the place, establishing there a toa base. It is now one of the four important naval centres of Italy. Pop. about 56,000.

TARANTULA, a large spider (Lycosa tarantula) with a body about an inch in length; its bite was formerly supposed to produce a kind of frenzy in human subjects called tarantism. The nervous actions of those victims are supposed to be imitated in the wild musical dance known among the Italians as tarantella. Doubtless in some cases its bite produces disagreeable symptoms. The species named is a native of Italy, but varieties, or closely allied species, are found throughout the south of Europe. The so-called tarantulas of Texas and adjacent countries are large species of Mygale.

TARANTULA-KILLER, a very large burrowing wasp (Pompilus formosus) of Texas and Oklahoma, which stings tarantulas, depositing its eggs in their bodies and carrying the paralyzed spider off to its nest. See WASPS.

TARAPACA, tá-rá-pá-ká', Chile, a province in the northern part of the country, between Bolivia and the Pacific Ocean. Area, 16,000 square miles. The main range of the Andes is in the eastern boundary, while a lower range runs along the coast. The entire intervening country is a rainless desert traversed by a few streams in narrow valleys. The importance of the province lies in its immense deposits of nitrate of soda. These are found in the interior deserts and railroads are built from the coast to reach them. There are also some silver mines in the coast range. The capital and chief port is Iquique. The province was occupied by Chilean troops in 1879 and was ceded to Chile by Peru by the Treaty of Peace in 1883. Pop. 125,961.

TARASCO, an ancient tribe of American Indians which formerly spread over all of the Mexican states of Michoacan, in Guanajuato and Queretaro. The Tarascos have been called half-breeds in the Mexican population, but Lumholtz states that he came across the pure stock nearly 200,000 strong, in 1800, still living in the mountains of Michoacan. According to their traditions they must have come from the northern regions, as did the Nahua- thanes. They do not call themselves Tarascos but name their tribe Purépecha. In consequence of their absorption with other races their original customs, in most sections, are fast disappearing. They never mention the sun except as Our Father Sun and they transact no business nor will they sell corn after sun-down. They worshipped the Southern Cross constellation. In each house they place in the best room pictures of a saint or saints, which are said to be in the room, while the priest of reverence to the saint, sleep in the kitchen; but they allow strangers to occupy that room. The entire series of their saints is called Tata Dios, Father God. Capital incense is burned before their house daily, and the visitor, before mentioning the reason of his arrival, first kisses the saint's picture. The tribe has a great love for music and almost every individual has his guitar. They are hard workers, especially the women, who are badly treated. Like most Indian tribes, the Tarascos are clever potters. Consult Lumholtz, K. S. (Unknown Mexico) (New York 1902).

TARASCON, tá-rás-kón, France, a town in the department of Bouches-du-Rhône, on the left bank of the Rhône, opposite Beaucaire, with which it is connected by a suspension-bridge, 55 miles north-northwest of Marseilles. It is surrounded by walls, flanked with towers and entered by three gates. The streets are wide and regular and one of them is lined with arcades. The principal buildings are the old castle, seated on a height overlooking the river; the church, a handsome Gothic structure of the 11th century, with a finely sculptured portal; the town-house, courthouse, theatre, general hospital and public library. Woolen cloth, serge, silk goods, hempen and cotton cloth, vermicelli, soap, starch and cordage are manufactured and there are also brandy distilleries, wax refiners, tanneries, brickworks and building-yards for barges. The trade is wine, brandy, oil, hemp, wool, wood, coal, medicinal plants, lucerne-seed and saddles. Tarascon is the Roman Tarascon and in an interesting type of the medieval town. It is the locale of Daudet's 'Tartarin de Tarascon.' Pop. 8,631.

TARAXACIN, a crystallizable substance found by Pollex in the milky juice of the root of the ordinary dandelion. It is bitter and acrid in taste. Used somewhat as an alterative and tonic.

TARBEll, Edmund C., American artist: b. West Groton, Mass., 1862. He was a pupil in the Boston Museum of Fine Arts and going to Paris was taught by Boullanger and Legeb. In 1900 he took the Clark prize at the National Academy of Design; the Shaw Fund, Society of American Artists (1903); medal at the Columbian Exposition and other awards at Philadelphia, Boston and Paris (bronze medal 1900). In 1906 he was elected to the National Academy. For many years he has been art critic at the Boston Museum. His pictures are distinguished by fine atmosphere and color and the bold truthfulness of his outdoor work borders on impressionism.

TARBEll, Frank Bigelow, American archaeologist: h. Groton, Mass., 1 Jan. 1853. He was graduated at Yale in 1873 and was assistant professor of Greek and instructor of logic there 1884-87 and was instructor of Greek at Harvard University 1889-92. He has been professor of classical archaeology at the University of Chicago from 1894 and has published 'The Philippi of Demosthenes' (1880); 'A History of Greek Art' (1896); 'Catalogue of Bronzes, etc., in Field Museum of National History' (1899).

TARBEll, Ida Minerva, American biographer: h. Erie, Pa., 1941; Nov. 18. She was graduated from Allegheny College, Meadville, Pa.; was associate editor of The Chautauquan 1893-91; studied at the Sorbonne and College de France, 1891-94; from 1901 to 1906 was on the editorial staff of McClure's Magazine; is now associate editor of The American Magazine. Her publications include a 'Short Life of Napoleon
TARRES—TARE

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té' (1895); 'Life of Madame Roland'
'Early Life of Abraham Lincoln'
M. Davis, 1896); 'Life of Abraham
(1900); 'History of the Standard Oil
p' (1904); 'He Knew Lincoln' (1908);
Abraham' (1909); 'The Tariff in our
(1911); 'The Business of Being a
' (1913); 'The Ways of Women'
'New Ideas in Business' (1916);
Men at Ford's' (1916).

BES, tärb, France, capital of the de-
t of Hautes-Pyrénées, 25 miles east of
the Adour, here crossed by a handsome
The cathedral is a modern structure,
on the site of the old castle of the
Bigorre, of whose territory Tarbes
capital; other buildings are the church
John, the church of the Carmelites,
remarkable spire; the prefecture, occu-
ting old episcopal palace; the civil hos-
lege and barracks. Leather and paper
manufactured and the trade includes, in
to, specialties, wine, iron, cattle and
eral produce. Tarbes is mentioned by
under the name of Bigorra. A famous
as fought here 20 Nov. 1814, the Eng-
ing the French. Pop. of the commune,

DÉE, tärd, Gabriel, French philoso-
Sarlat, Dordogne, 1843; d. Paris, 1904.
illed law, became juge d'instruction in
his town and held this position for nearly
He began his contribution to the
'Kilologique' in 1880 and between 1882
4 published in it his first studies of the
universal repetition and imitation. In
was called to Paris to assume control
ureau of Statistics of the Ministry of
He relinquished this post in 1900 and
professor of modern philosophy in the
de France; in that year, also, he was
to the Institute of France. His writ-
largely with the laws that govern
in their social relations; now new
'e' brought out. He lived and worked in
is custom. He was a thorough believer
he that 99 men are imitators to one
His studies in criminology contain
His publications, several of which
been translated into English, in
Les Lois de l'Imitation' (1890); 'La
ité comparée et La Philosophie'
(1891); 'La Logique sociale' (1895);
sition universelle' (1897) and 'Les Lois
(1898): 'Essais et Mélanges Socio-
(1895); 'L'Opinion et la Foule'
'Psychologie Economique' (1901);
ground Man' (1905). Consult 'Gabriel
with preface by Bergson (1909).

DIBU, tärd'ye, André Pierre Ga-
medée, French publicist and administra-
2 Sept. 1876. He passed out first in his
on the École Normale and entered the
tic service, being attached to the French
in Berlin in 1897. He served a while
Foreign Office and as a secretary in the
of the Council of Ministers 1899-
le was editor of the 'Revue des Deux-
and became foreign editor of the
He paid a visit to the United States
and recorded his impressions of that
in a French journal, and in 1904 in the
(1908). Of President Roosevelt, whom

he interviewed, he wrote then, 'What particu-
larly characterizes his policy is its essential and
emphatic Americanism,' an estimate corrobo-
ated by all Americans on the death of that
statesman 11 years later. M. Tardieu entered
in the general election preceding the out-
break of the war. He was made chief censor,
post he soon left for active service in the
rench. Incapacitated by a severe attack of
 pneumonia, brought on by exposure, he was
appointed head of the French mission to the
United States in 1917. He labored at
Washington and elsewhere for the business
iciency of the Allies and the co-ordination of
their economic strength. Returning to France
shortly after the formation of the Clemenceau
ministry, he later made another important trip
to America and subsequently remained in Paris
as high commissioner for all matters concern-
ing France and the United States. He was
the youngest delegate to the Peace Conference
In Paris. He wrote several excellent books on
European politics; his 'Questions diplomatiques
de l'année 1904' was 'crowned' by the
French Academy. A remarkable work is his
'Le Mystère d'Agadir,' dealing with Morocco
and Germany. He also wrote 'La Conférence
d'Algesiras' and 'France et les Alliances' (Paris
1907).

TARDIGRADA, tär'dë-gräd'a, a term in
zoology applied (1) to the group of sloths and
(2) to a group of microscopic animals also
known as water-bears, which are usually classed
with the Arachnida. The water-bears have a
cylindrical body bearing four pairs of short,
clawed feet, while the mouth is furnished
with two stylet-like rods. The nervous system
is much like that of annelids; circulatory
and respiratory organs are lacking. These
animals are hermaphrodite, and when the eggs are fer-
tilized the skin of the body is shed, the eggs
remaining in it. The development is more like
that of the annelids than like that of the
arachnids, and the relation of these animals to
the spiders is more than that of the fish relates
all live in fresh water, being common in
and fresh-water algae. Most of the species will
stand prolonged drying and will revive upon
being placed in water.

TARDIVEL, tär'dè-vél, Jules Paul, Ca-
adian journalist: b. Covington, Ky., 1851; d.
1905. He went to Canada in his 17th year and
was educated at Saint Hyacinth College. He
entered the service of 'La Minerve' and 'Le
Canadien' and (1881) established 'La Verité'
of Quebec, being its editor as well as proprietor
for a lengthy period. As a staunch Catholic he
propagated the creed in political matters, op-
posing liberalism and Freemasonry. He was
an advocate for entire independence of the
province of Quebec and secession from the
Canadian Confederation. He wrote 'La Vie du
Pape Pie IX, ses œuvres et ses douleurs' (1878);
'Notes de voyage' (1890); 'Pour le
patrie' (1895), a novel attacking Free-
masonry.

TARE, any of several plants. The tare
mentioned in the Bible (Matt. xiii, 25) is sup-
pposed to be darnel ('Lotium temulentum'),
since the Greek word 'Lotus' ("wild rice") is used in
the oldest Greek manuscripts. Darnel is distin-
ct from the wild rice and eating its seeds was for-
merly supposed to produce stupefaction. The modern tares are all members of the family *Papaveraceae*. The name is most commonly used for *Vicia sativa*, better known in England and America as the common vetch. This plant is cultivated to some extent in Europe because it will thrive upon poor soils and produce forage where other plants usually fail. Its yield is small, but in such places it is deemed worth while to be so used as a means of improving poor land. Its close relative, the wild vetch (*V. hirsuta*), also loosely called tare, is similarly named and used, but it is more often ranked as a weed.

**TARE,** in commercial technology, is an allowance for the outside packages of goods which cannot be packed without detriment, which is deducted from the weight if it be bought by the pound. Obviously the papers, threads, bands, etc., that enclose or hold any goods imported loose cannot be conveniently separated for weighing nor, in many cases, can casks or cases be weighed separately from their contents.

**TARENTUM,** ta-reno'tum, Pa., borough in Allegheny County, on the Allegheny River, and on the Pennsylvania and the Allegheny Valley railroads, about 20 miles northeast of Pittsburgh. It is in an agricultural and coal mining region. The chief manufacturing establishments are paper mills, glass factories, foundries, machine shops, flour mills and planing mills. It is a typical manufacturing town and its 65 factories turn out about $3,000,000 in products annually. There are banks and newspapers. The educational institutions are a public high school, public and parish elementary schools and a public library. Pop. 7,414.

**TARENTUM.** *See Taranto.*

**TARGUM,** the translation of the Old Testament Scriptures into Aramaic. This version originated at a time when Hebrew had given way to Aramaic as the popular language of the Jews. The need of explaining the old Scriptures to the people after their subjugation by the Persians is suggested by Nehemiah viii, 8, where we read that Ezra read the law to the people, while it was interpreted by his assistants, interpreters—Meturegans as they were called. As the Targum was not committed to writing, little of it has survived. There are indeed three Targums of the Pentateuch and of the Prophets, as well as of the Psalms, Job, Proverbs, the Song of Songs, Ruth, Lamentations, Esther and Ecclesiastes. The Targum is not of much critical value, but throws considerable light on the life of the Jews at the time it was composed. Consult Berlinger, A., *Targum Ontale* (Berlin 1854); Lacardere, *Propheète Chaldéen* (Leipzig 1872).

**TARIFF.** The taxation of goods by the imposition of customs duties upon passing the national boundary, is a special mode of raising revenue. The earliest form of this tax was probably the transit duty imposed on goods passing through a district and was justified as a payment for protection or for special facilities. The export duty levied on goods as they leave the taxing territory, came next in historical order. What in fact could be more just, it was thought, than a tax upon goods of whose use the home community would be deprived and the burden of which would be borne by the foreign consumer. Finally there developed import duties which are made use of in all civilized states to-day. Transit duties have disappeared as a form of national finance; export duties are of fiscal importance to-day only in Turkey and India. But import duties contribute a large though variable proportion of the revenues of the United States and of the leading European states. In the United States before the imposition of the income tax they made up nearly one-half of the Federal receipts; before the European War they constituted about one-half of the net receipts of the German Empire; about one-quarter of the total revenues of England; and about 15 per cent of those of France and Italy.

Among the civilized nations of antiquity tariffs for revenue purposes were generally used. The Greeks, and more especially the Athenians, levied customs duties upon both imports and exports, the usual rate being about 2 per cent. The Roman state levied regularly to this form of taxation. With the breakdown of centralized government during the Middle Ages the feudal lords claimed the right of imposing transit duties on goods passing through their domains, nominally in payment for protection. When feudalism in turn gave way to strong monarchies the rights of the lords in this regard were exercised by the kings and to local tariffs were added national ones. Every European country was covered with a network of customs lines which greatly hindered trade, but were not productive of commensurate revenues. The history of modern tariff legislation has been the simplification of this complicated system.

In England a complex system of import and export duties had slowly developed by the constant addition of new objects of taxation and by the confusing practice of assigning the proceeds of each new duty to a different purpose or fund. In 1787 Pitt consolidated all of the tariff duties into one general fund. At this time about 1,200 articles were subject to import duties and about 50 to export duties. The next step in the direction of simplification of the tariff was effected in 1824 by Huskisson, who abolished most of the export duties, freed raw materials of their burdens and consolidated a mass of tariff acts. The real beginning of modern English free trade was made during the period 1842-45, when some 9,816 articles were placed on the free list. Practically the only articles upon which import duties were collected after 1860 were sugar, cocoa, coffee, chicory, dried fruit, tea, tobacco, wine, beer and spirits. In spite of the decrease in the number of dutiable articles the revenues from the few remaining ones steadily increased, with a corresponding reduction in cost and simplification of administration. With the increasing competition of German and American manufacturers, especially since about 1900, a reaction in favor of protection has arisen in some quarters. Since the outbreak of the European War this movement has taken the form of a demand for protection for the colonies.

In France the diverse and multifarious provincial tariffs were swept away in 1790 and the following year a common and uniform tariff
foreign countries was established. For some time France had now economic unity. There were at first moderate, but under them they were highly protective, which was continued under the Resto
nd extended to agriculture as well as tures. Under the monarchy of Louis the government was administered in the same manner as high tariffs, duties, and costs were made highly protective, which was continued under the Restor
ital policy was introduced which cul
in the Commercial Treaty of 1860 with
. By 1881 the pendulum had swung their direction again, and the new tariff year was much more protective. A higher protection was extended to agricul
and since that time France has main
policies of all-around protection and self-sufficiency.
Its tariff policy has moved along different lines. At the beginning of the century the present German Empire group of mutually antagonistic states a few years ago when they were at war, at problem was to unite them under a regional tariff and to abolish the local e tariffs. This was finally accomplished under the leadership of Prussia by the Zoll
which continued from 1834 to the event of the German Empire in 1871, complete economic unity was effected. 1. Ifs under the Zollverein had been mod
now they moved still further in the direction of further tariff protection, but in 1878 a change
le to protection which has since been further, covering agriculture as well as manufactures. The tariff has been made more political as well as industrial and massive in Germany.
The United States customs duties have ed from the earliest colonial period. Every colonial assembly levied import or its own treasury in addition to those by Great Britain in the execution of Navigation Acts. They seemed to have been or sumptuary, retaliatory or protective, quite as much as for fiscal ends. Colonial tariffs have been classified under four heads: (1) tonnage taxes on shipping; (2) export duties on goods and other colonial staples; (3) im
ies on slaves; (4) regular tariff of goods. wines and liquors were the most it items. These duties were generally valued duties ranging from 1 to 5 ; but even with these rates seem to largely evaded.
Tonal tariff act was made possible by lation of the Constitution and the first legislation by Congress was the passage
y 1789 of such an act. The main pur
this was revenue, but protection was end to certain industries which it red to encourage, as glass and earthen
h the tariff rate of duty, however, was about 8 1/2 per cent, but in those days was a more effective barrier than it has been. No important changes were made
Act of 1816, but in the meantime the several tariff acts of those acts and the War which had interrupted foreign trade, ed into being manufactures of which now felt care should be taken. Ac

Accordingly this tariff act gave a substantial measure of protection to those industries most exposed to foreign competition, namely, textiles, hats, cabinet wares, flannel and calico. By 1824 other industries were demanding protection such as iron, wool, hemp, glass and lead and a general revision was made in the tariff, resulting in a raising of rates throughout the list but especially in the case of iron and steel. For the next few years there was continuous agitation of the tariff question, led by the woolen manufacturers who wished further protection. A convention of the friends of protection was held in Harrisburg in 1827 and systematic propaganda was carried on. The result was the tariff of 1828 which granted the highest protection yet accorded in any act, the chief beneficiaries being the cotton and woolen industries. This "tariff of abominations," as it was called, caused intense opposition both in the North and in the South, and it was replaced in 1832 by a more moderate act which eliminated the worst features of the previous tariff and put the duties back at about the point where they were in 1824.

The opposition of the South, however, was too great to be appeased by any half-way measures and in the next year it flamed out in nullification. South Carolina declared the Tariff Acts of 1828 and 1832 null and void and not binding upon the State or its citizens. In order to placate the opponents of protection and at the same time prevent too sudden and radical a revision of duties, Clay introduced the so-called Compromise "Tariff of 1833. This provided for a gradual reduction of all duties over 20 per cent to a 20 per cent level by an annual excision of one-tenth per cent until 1842 when they were all to be placed at that point. This agreement was carried out and the reductions took place according to schedule. Hardly had this been effected, however, than the protectionists seized upon the decline in revenues which had followed the panic of 1837 as an excuse for another revision of the tariff, and time in the direction of much higher duties; in general, the Act of 1842 returned to about the level of the Act of 1832. By 1846 good times had returned, there was a surplus in the treasury and a Democratic President and Congress were in office. They decided to make a radical change in the tariff policy which they enacted into law in the Act of 1846. This has often been called a free trade tariff, but it still retained a considerable protectionist flavor although the rates on the great bulk of commercial products were reduced to between 15 and 30 per cent. The next few years were years of unparalleled business prosperity and commercial expansion and the revenues from import duties increased by leaps and bounds. The need of a reduction of revenue was so obvious that in 1857 another tariff measure was enacted lowering many of the duties and enlarging the free list. Before this act was fairly in effect, however, the panic of 1857 put down importations to such an extent that a deficit resulted and accordingly in 1861 the previous duties were restored.

When the Civil War broke out the necessity for revenue outweighed all other considerations. Heavy excise duties were placed upon domestic manufactures and to compensate these the import duties were raised correspondingly.
and in some cases a little more. This was done in 1862, the average rate being raised to 37 per cent. The same procedure was followed again in 1864 except that a somewhat greater amount of protection was granted, the average rates being increased by this act to 47 per cent. After the war efforts to reduce the tariff to the ante-hellum basis met with resistance from the protected interests and practically nothing was done until 1870. In that year the duties on articles like tea, coffee, wine, sugar, molasses and spices, which did not affect domestic industries, were reduced. Again in 1872 a general revision was avoided by making a 10 per cent horizontal reduction of all duties and abolishing entirely those on tea and coffee and a few other articles. The loss of revenue resulting from the sacrifice of duties, amounting to about $20,000,000 from tea and coffee, and the shrinkage of other receipts as a result of the panic of 1873, resulted in a deficit of $2,000,000 and in 1875 the 10 per cent horizontal reduction was repealed. The period of depression came to an end about 1878 and with the return of prosperity a surplus began to heap up in the treasury again. In 1887 the public was granted power to propose changes, but their recommendations for a reduction of the tariff were rejected by Congress. Internal revenue duties were abolished or reduced, but the import duties were on the whole increased.

This action called forth strong protest from the Democrats, and in 1887 President Cleveland brought the issue to a head by a vigorous message urging tariff reform and the necessity of reducing the surplus. Up to this time the surplus revenues had been applied to the payment of the debt, but all available bonds had now been paid. The Democratic House passed the Mills bill providing for a general reduction of the tariff, but the Republican Senate replied by proposing further cuts in internal revenue duties. In the ensuing elections the Republicans were victorious and proceeded to solve the problem of the surplus by the double process of spending it and raising the import duties by the McKinley Act so as to accrue to the treasury. Extravagant protection legislation was inaugurated and a bounty of two cents a pound given to domestic sugar producers; at the same time imported sugar was admitted free, thus sacrificing an annual revenue of $30,000,000. These actions effectively removed the surplus and indeed paved the way for a deficit, which occurred when the panic of 1893 broke upon the country. The Democratic tariff of 1894 reduced the duties on many protected commodities, added to the free list, restored the duty on sugar and provided for an income tax. The failure of the income tax section, however, by being declared unconstitutional, and the continuing depression led to embarrassing deficits, and when the Republicans were returned to power in 1896 they promptly declared the passage of the Dawes-Tariff in 1897, raising the general average of duties to the highest point since the Civil War, namely, 57 per cent. This was an increase from 37 per cent in 1893 and 49.5 per cent in 1895.

The tariff now remained undisturbed for 12 years, but dissatisfaction with the existing duties grew strong, especially with the burdens on raw materials and the favors to monopolized industries. Efforts were made within the Republican party itself, especially by members representing the Middle West, to secure a revision of those duties favorable to the farmers, although without success, but finally in 1909 a campaign pledge was made by this party to revise the tariff. The Payne-Aldrich Tariff of 1909 was an attempt to redeem this pledge, but the protective interests united in preventing any serious reductions in schedules. This repudiation of party pledges led to an insurgent movement which found expression in the Progressive party and swept the Democrats into power at the next election. The Underwood Tariff of 1913 made important changes, especially in the iron and steel schedules; free wool was provided for, a gradual reduction of the sugar duty with ultimate free sugar, and the general free raw materials were manufactures. The outbreak of the European War the following year necessitated the suspension of the reduction of sugar duties, thus saving a revenue of some $45,000,000 a year. The enormous revenues needed to defray our expenditures since the entry of the United States into the war have been provided, as in the case of the Spanish War in 1898, by increasing the internal revenue taxes and by income, inheritance and excess profits taxes. An expert tariff commission was provided for by the Tariff Act of 8 Sept. 1916, which it is expected will supply the machinery and the information for the scientific solution of the difficult problems of tariff adjustment after the war.


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TARIFF ADMINISTRATION IN THE UNITED STATES. The administration of the tariff laws, which comes within the province of the Treasury Department, is directed under the care of the Secretary of the Treasury and one of his assistant secretaries. The machinery furnished by the department and the government for its execution is comprehensive, complicated and far-reaching. All articles imported must follow a certain prescribed and unchangeable routine which begins with the requirement of a certificate of value made before a United States consular office abroad, for every shipment of foreign merchandise destined for entry into the United States. The exact methods of entry of goods, the valuation of the same, their classification and the rate of duties to be paid, in each case, are minutely and exhaustively prescribed; and provision is made for appeal of the interpretation of the Tariff Law, the classification of articles, the tariff charges or duties and, in fact,
er injustice or irregularity that may connection with the administration of . This system of appeal is very elabo-
i is at the service of the importers government alike. Naturally the tariff
tation takes charge of the collection of the import duties. It does directly notwithstanding that the extent and importance of the port cities would seem not only to justify
mand, as in the case of the internal a separate customs bureau. The dif-
the country into customs districts
the collection of customs through the ports of entry. These ports of entry
subject to strict routine regulate are provided each with an adminis-
staff adequate to its needs. This staff
larger and more important ports of
cludes a collector, appraiser, sur-
angers, inspectors, a naval officer and
in accordance with the importance of
. By law no goods destined for im-
entry may be presented at any
ce one of these ports of entry,
re government has provided for the
and warehousing of goods for the or for longer periods of time in case
they should not wish to make due use of
imported. The latter may defer the
of duties, if he so desire, until it is
nt for him to take the goods out of
house. The unloading of all goods
for importation must be done under
of the customs officials and shed
within a certain specified time.
facilitated by the requirement which
from a foreign country, a manifesto
re of the cargo, the names of the con-
ports of shipment and other informa-
t nature, which must be submitted
receipts and shipment, according to
like nature, which must be submitted
revenue officers before reaching the
so desired, and delivered to the collec-
reaching port, in order to secure

t the duty by bond. In the case of collec-
case the consignee is dissatisfied with
aisement, a new one may be ordered,
s is denied at the port, an appeal
made to the board of general apprais-
reconsideration of the valuation. The
States Court of Customs Appeals as
to classification and other matters. This permits the remedy of
injustices of all kinds in the ad-
ion of the tariff laws and regula-
nd this makes the United States tariff
ration very efficient and just to all.
ector receives the duties and pays-
er to the Treasury Department. (See
ADMINISTRATION). Consult Bolles, A. S.,
History of the United States
Devan, D. R. (Financial History of
ed States') (1903); Goss, J. D., (His-
Tariff Administration in the United
(1891).

IFL LAWS, the various enactments of
; extending from 1789 to 1913, to regu-
ort duties. Those of recent date are:
The Morrill Tariff Act (1861); McKinley Tariff
Act (1890); Wilson-Gorman Tariff (1894); Dingley Tariff Act (1897); Payne-Aldrich
Tariff Act (1909); Underwood Tariff Act (1913). See TARIFF ADMINISTRATION IN THE
UNITED STATES.

TARIJA, tā-rē'kō' Bolivia, the capital of
the department of the same name, situated
among the mountains near the Argentine fron-
tier and having an area of 31,567 square miles.
It lies on a fertile mountain plain and has a
pleasant climate. The town has a handsome
church, and there is considerable transit trade
with Argentina. Pop. of town, about 10,000;
department, about 165,000.

TARIM, tā-rēm', central Asia, a river of
East Turkestan, formed by the confluence of
the Aksu, Yarkand and Khotan-Darya at the
southern base of the western Tyan-Shan
ranges, 60 miles southeast of Aksu. Thence
it flows east and finally southeast, losing itself
in the group of lakes and salt marshes known as
Lob-nor, at the northern base of the Kuen-Lun
range. With its main headstream, the
Yarkand, the Tarim River encircles the vast des-
cert plain of Turkestan, receiving nearly all its
tributaries from the surrounding mountains on
its left bank. The Tarim and its basin were
first thoroughly explored and mapped by Hedin,
during the last years of the 19th century.

TARKINGTON, (Newton) Booth, American
novelist: b. Indiana, 29 July 1869. He was
graduated from Princeton in 1893 and his first
novel, 'The Gentleman from Indiana' (1899),
attracted widespread and favorable attention.
Thenceforth he followed literature, with the
exception of serving one term in the Indiana
legislature in 1903. His next works were
'Monsieur Beaucaire' (1900); 'The Two
Vanrevels' (1902); 'Cherry' (1903); 'The Beau-
tiful Lady' (1905); 'The Conquest of Canaan'
(1905); 'Gust of Quesmay' (1908); 'Beauty
and the Jaquot' (1911); 'The Art' (1912);
'Penrod' (1914); 'Seventeen' (1916); 'Tur-
mol' (1917); 'Robert Cortes Holiday'
(1918); 'The Magnificent Ambersons' (1918).
He has also written several plays, the most
successful being 'Monsieur Beaucaire' (after
the novel), in which he collaborated with
Harry L. Wilson.

TARKIO (tār'kē-ō) COLLEGE, located at
Tarkio, Mo. It was established by private
initiative in 1883 under the name of Tarkio
Valley College and Normal Institute. A new
charter was obtained in 1884 by which the name
was changed to Tarkio College and the institu-
tion came under the control of the United
Presbyterian Church. The college has from
the first coeducational. Its organization
includes a collegiate department, a normal
department, a preparatory department, a tech-
ical department and a commercial department.
The collegiate department offers two courses
leading to a degree, the classical (degree of
A.B.), and the scientific (B.S.), and a third
course, the literary, for the completion of
which a diploma is granted; this latter
omits one year of the work of the scientific
course. The normal course occupies four years; stu-
dents are allowed to pursue the studies they
most need. Students in both this and the com-
mmercial department can take additional studies in any of the collegiate courses. Bible study is a part of the curriculum in the preparatory and collegiate courses. The college has a campus of 20 acres a little above the town; the chief buildings are the main building, Marshall Hall (women's dormitory) and Gentleman's Hall. In 1901 David Rankin gave $53,000 toward the increase of the permanent endowment, and the productive funds were in 1917 $163,000. The library in 1917 contained 8,300 volumes; the students numbered 235 and the faculty 23.

TARLAC, tār'lāk, Philippines, (1) Pueblo, capital of the province of Tarlac, Luzon, on the Bolso River at the point where its name changes to Tarlac, and on the Manila and Dagupan Railroad, 73 miles northwest of Manila. In addition to the railroad it has excellent highway facilities, and is the centre of trade for the surrounding country. Pop. 12,340.

An interior province in the southwestern part of northern Luzon, bounded on the north by Pangasinan, on the east by Nueva Ecija, on the south by Pampanga and on the west by Zambales. Area, 1,715 square miles; altitude, approximately square, measuring 37 miles from north to south and 39 miles from east to west; the eastern part is level, while the western part includes the eastern slopes of the Cordillera de Calusacan, the highest peak being Mount Ha, 1,004 feet. The province is watered by numerous rivers. Rice is the most important product; sugar is also raised in large quantities, and tobacco and corn on the higher levels. The forests are valuable, and the timber is easily obtained on account of the numerous rivers, and their proximity to the forest lands. There are a few mechanical industries for domestic use only. The province is traversed by the Manila and Dagupan Railroad, the main highways and numerous lesser roads; the rivers also are navigable for native boats, so that the facilities for trade are excellent. Pop. about 135,000.

TARLATAN, a thin and fine species of open, transparent muslin, mostly used for women's wear, originally esteemed as high grade, but later deteriorated. The chief seat of the trade is Calcutta.

TARLETON, Sir Banastre, English soldier in the Revolution; b. Liverpool, 1754; d. Leintwardine, Shropshire, 25 Jan. 1833. In 1775 he entered the English army as cornet in the king's dragoon guards, and obtained leave to accompany Lord Cornwallis to North America, as volunteer. He was present with Clinton's army at the attack on Charleston and other operations, then served with Sir William Erskine's cavalry, attacking and capturing New York (September 1776), Fort Washington and Fort Lee in November. He commanded the advance guard under Haerquert and captured General Lee (13 December) and was present in operations around Brunswick, Princeton and Trenton (1777). In 1780 he fought around Charleston capturing (by surprise) three regiments of American cavalry, with their stores, just before the capitulation of Charleston. He aided in the capture of Camden. In the South he had to retreat, after Morgan's victory at Cowpens, in Hamilton Ford. Joining Leslie in January 1780 they returned and successfully attacked Morgan. But in spite of Tarleton's numerous successes the attacks of Lafayette and Wayne rendered the Cornwallis position hopeless and, with the surrender to Washington, Tarleton returned to England (1782) on parole. He was made lieutenant-colonel of light dragoons in December, the new reorganized Parliament (1780) representing Liverpool, retaining his seat till 1807. In 1807 he was again elected to sit till 1812, giving his seat to Canning. He was promoted (1790) to colonel, then to major-general (1794) and lieutenant-general (1798). After several short commissions to Ireland and elsewhere he was made (1818) governor of Berwick and Holy Island. In 1812 he was promoted to general and was created baronet in 1815. He was certainly a clever, daring and successful leader of cavalry, but history would give him the blame for unnecessary cruelty, resorting at times to butchery. He wrote 'History of the Campaigns of 1790 and 1791 in the Southern Provinces of North America' (London 1797).

TARN, tārn (ancient Tarnis), a river of France, which rises on the south slope of Mount Lozère, near Florac, in the department of Lozère. It flows west-southwest, crosses the departments of Aveyron and Tarn, passing Alby, turns northwest through Haute-Garonne into Tarn-et-Garonne, where it passes Montauban, turning almost due west, passes Moissac, and joins the Garonne on the right a few miles below. Its whole course is 230 miles, of which about 100 miles, beginning at Alby, are navigable.

TARNOPOL, tān'pōl, Austria, town Galicia, on the left bank of the Sereth, 80 east-southeast of Lemberg, near the Russian border. It has a Roman Catholic and a Greek Catholic church, an old castle, now used as barracks, a new castle, a Jesuit college, a gymnasium, a Polish real-school and several of schools. A thriving trade in refining and brewing, horses, grain, wax, honey, etc., is carried on. Pop. about 35,200.

TARO, a plant (Colocasia antiquorum esculenta and related forms) of the arum family, widely grown for food in tropical regions, especially in the Islands of the South Pacific. The plant has very large heart-shaped leaves, from thick tuberous roots, and small greenish flowers, resembling those of the calla, to which it is related. A form, still grown in Egypt and used as food by the laboring classes, is known to be of great antiquity. In the Pacific region hundreds of forms of taro are recognized by the natives. Taro is used in Hawaii chiefly in the form of poi, a paste made by boiling and grinding the roots and allowing them to ferment for a day of two. The roots are used in many other ways, like the potato. The leaves, also, when cooked to destroy their acridity, are used for food.

TARPAN, a local name for the Asiatic wild ass.

TARPAULIN, originally a broad piece of canvas, thoroughly coated with tar, and used to cover the hatchways of a ship at sea, to prevent the penetration of the rain or seawater which may at times rush over the decks; now any heavy waterproof canvas for protecting goods from water.
TARPEIAN ROCK—TARQUINIUS

TARPEIAN (tär-pé'yán) ROCK, Italy, a
hill at the Capitol at Rome, so named from
legend that during a war with the Sa-
arpeia, the daughter of the governor
of Rome, promised to open the
the city to the Sabines, provided they
what they carried on their left hands,
the Sabine public to the Capitol,
d, and as they entered the gates threw
bracelets but their shields upon Tar-
io was crushed to death under the
She was buried in the Capitol, which
named the Tarpeian Rock; and
Roman malefactors were afterward
down a deep precipice. See ROME.

PON, or SILVER KING, a great
erful fish (Tarpon atlanticus, or Megal-
azaoides), known from Virginia to
and regarded by anglers as the finest
American game fish. It is related to the
and resembles them in general out-
is sometimes six feet long. Its special
the long filamentous appendage of the
margin of the dorsal fin and the
und, which is used as the
in armor of glittering silver, and make
silver king peculiarly appropriate
noble fish. Among the French and
fishermen about the Gulf of Mexico
berg. It is called grande escotte,
valle, etc., while tarpion, jewfish and
herring are also heard. Its scales, as
or larger than a silver dollar, are ex-
used in fabricating ornaments, and the
food to eat; but the fish is principally
for the sport it affords to the angler
line, who seeks it best by going
, with an experienced man at the oars,

TARQUINIUS, Lucius (surnamed Su-
PERBUS), last of the legendary kings of Rome,
was the son of Lucius Tarquinius Priscus.
Tarquinius Priscus left two sons, who were
himself too young to succeed him in the
his son-in-law, Servius Tullius, excited the patricians
against him by extensive constitutional reforms,
and Tarquin, on reaching man's estate,
murdered his son-in-law and assumed the regal
dignity as a hereditary right. As a king he
developed all the distinguishing traits of a
tyrant. He abolished the privileges conferred
by his predecessor on the plebeians; but did not
favor the patricians. He banished or put to
death the senators whom he suspected. He
continued the great works of his father,
compelled the populace to labor in the
for inadequate pay. While he thus established
his tyranny at home he advanced the power of
Rome abroad. By the marriage of his daughter
Octavia Mamilius of Tuscum, he
caused himself to be recognized as the head of
the Latin confederacy. Through a stratagem
of his son Sextus he obtained possession of
Gabin, a Latin city, which resisted him. He
made war on the Volscians, and took the city
of Suessa Pometeria, the spoils of which he
used to build and decorate the Capitol. He
formed also a close alliance with the Etrurian
cities. To keep down the Volscians, he founded
the colonies of Signia and Circeo. It was he
who deposited the Sibyline books in the vault
of the Capitol. After a reign of nearly 25
years he was engaged in besieging Ardea when
the conspiracy broke out by which he was
exiled from Rome 510 B.C. The cause and nature
of the conspiracy are referred to in the articles
BRUTUS (LUCIUS JUNIUS) and LUCRETIA. Tar-
quins first took refuge at Cerc and Etruria. The
Etruscan cities of Tarquinius and Veii first
espoused his cause, then Lars Porsenna of
Clusium, and afterward the Latin states.
When all these had been vanquished, according
to Roman accounts, Tarquinius, whose sons had
perished in the wars, fled to Cumae, where he
died. The chronology of the story of the Tar-
quins is incompatible with strict historical
accuracy, and neither contemporary
public statements nor a mass of accounts has enabled historians to disentangle
the truth from fiction. Some, as Niebuhr and
K. O. Müller, hold that the history of the Tar-
quins points to an Etruscan conquest of Rome.
Others accept the main incidents as historical.
TARR, Ralph Stockman, American geologist: b. Gloucester, Mass., 15 Jan. 1864; d. 1912. He was graduated from Harvard in 1891, and was assistant in geology there 1890-91. From 1892-97 he was assistant in geology at Cornell University, and thereafter at dynamic geology there until his demise. He has published 'Economic Geology of the United States' (1893); 'Elementary Physical Geography' (1895); 'Elementary Geology' (1897); 'Physical Geology' (N.Y. 1902); 'Geography of Science' (1905); 'Alaskan Glacier Studies' (1914); 'College Physiography' (1914).

TARRAGON, a culinary herb. See Artenisia.

TARRAGONA, tár-rá-go'ná, Spain, a seaport town on the Mediterranean, capital of a province of the same name, in Catalonia, 60 miles west-southwest of Barcelona, at the eastern end of the fertile Campo de Tarragona, which is watered by the river Francoli. The old town, situated on a high rocky site, once surmounted by a citadel, has irregular streets. The chief features are the splendid cathedral and the tower, with a fine west facade and cloisters of great beauty, the archiepiscopal palace, with an ancient tower, and a seminary for priests. The Plaza de la Fuente, on the site of the Roman Circus, separates the old town from the more regular new town to the southwest, which, near where it joins the old town, is crossed by two broad tree-shaded streets. The Paseo de Santa Clara is a fine promenade on the remains of the old Roman walls. The other edifices include the preside or prison, the Torreón de Pilatos, also a prison, the Casa Provincial de Beneficencia, artillery arsenal, infantry barracks, etc. The town and its neighborhood are rich in Roman remains. The spacious harbor is sheltered by a long mole, and has been recently improved. Tarragona was known to the Romans as Tarraco. It was captured by the Romans 218 B.C. during the Second Punic War, and made their headquarters in Spain. It is also called Tarraco Maior, that is to say, Tarraco maior, the latter of whom made it the capital of the province of Hispania Tarraconensis. It was taken by the Visigoths in 475 A.D., and by the Moors in 713. On 29 June 1811 it was captured and plundered by the French under Suchet. Its archbishop shares with the archbishop of Toledo the title of primate of Spain. Pop. town, 24,548; province, 336,763.

TARRYTOWN (from the Dutch, Terwegen Dorp, "Wheat Town"), N. Y., village, Westchester County, on the Hudson River, or the expansion of the river called Tappan Zee, and on New York Central and Hudson River Railroad, about 25 miles north of New York and 100 miles south of Albany. A ferry, which connects the village with Nyack on the west bank of the Hudson, gives Tarrytown the advantage of the water. Tarrytown is one of the oldest settlements in New York; its position on the Hudson made it a convenient landing place for boats going from New York to Albany, and gradually it became a trading post. Its first incorporation included Irvington (1817). During the Revolutionary War Tarrytown was a centre of importance; every prominent hill in the vicinity was scene of an encounter or a fortification. Tarrytown André was captured. On Br one of the prominent streets, about half Sleepy Hollow (q.v.) stands a monument memorating the spot so important to Independence. The first monument was a small obelisk, raised in 1853 by inhabitants of the county, and bearing a pedestal an inscription which told that it is the "spot" where St. John Andre was captured by Paulding, Davila Williams, and Isaac Van All Natives of this County. In 1880, the centennial anniversary of this capture, the added a bronze statue of John Paulding; bronze panel, upon which was picture Theodore Bauer, the capture of André additions of 1880 were the gift of John son. The little stream nearby is called Brook, and a large whitewood, which stood near the monument, was called the tree. In 1777 Vaughan's troops landed and here, at the tavern kept by Elizabeth Tassell, occurred the capture of the Bri Major Hunt and a force of volunteers. The village is well laid out, and is the birthplace and home of Washington (q.v.). On the north is Sleepy Hollow where he was buried, on the south is Tappan Zee (q.v.), where his home stands. Other porion of Tarrytown include "Lyndhurst," formerly "Paulding Manor", Philipse manor house, erected in 1663; a monument to the Revolutionary soldiers manor, unveiled in 1894; and the sumptuaries of many of the noted men of New Tarrytown is in an agricultural region has about 100 manufacturing establi with a large annual output. The principal buildings are the Institution of Me orphanage for boys; the churches, scho business and schools. The educational insti are the Washington Irving High School, Institute, Miss C. E. Mason's Scho Knox School, Hackley School, Mary School, public and parochial schools, three libraries and two academies. The national bank has a capital of $100,000, it ing bank has deposits amounting to $2,000,000. Pop. about 5,752; including Tarrytown, 4,877; which is industrially of the village; total, 10,629.

TARSHISH, a place frequently men in the Old Testament. It was formerly believed to be Tarshish in Sicily, but is nonlinearly identified by Biblical critics with Tartessus of the Greek and Roman This name was applied to a district in the of Spain, lying to the west of the Gulf of Hercules. Others regard it as some tified European coast west of Greece.

TARSHA (Ital. Intarsia). Wood especially that done in Italy at the close Middle Ages and during the era of the Renaissance. The word is recorded being the only one describing inlay of character as distinguished from o others. Thus nearly all Tarsha work in dark wood like walnut, on which the lines and curves are incised rather dee the incisions then filled with light colors, producing, when the work is complete, a
vellow on brown. These lines and scrolls of different patterns which are carved in caps of foli, in this way help to carry out the great arabesque decoration which we, associate with the Renaissance proper in all the schools.

Heavy furniture, such as cupboards, chests, and monk beds for the storing of books, and the like, are adorned in this the most effective examples of the art of wooden fittings of church choirs and rows of cupboards and closets (am-buch) line some of the sacries of the in central and northern Italy.

Inlay of later times and of the North often called Tarsia, but the process is of the style of the time. The most wood inlay of Italy is that of chests of drawers, wardrobe and tables in which spirited little bouquets of flowers are relied on a dark ground. All northern inlaid work, disappear in century in what we call Marquetry which is a mosaic of veneers rather inlay. Consult Jackson, F. Hamilton, and Marquetry (1903).

SIER, a small emer of the genus having extremely long hind legs, es-n in the thin tarsal portion, large, slender, enormous eyes. These grotesque little organisms inhabit tropical Africa and the East African islands. They are for the most part rai with orchids and feed on roots and in- nents in the trees near them spending their life in these spots where they spend a. The tarsier (F. spectrum) is a rep- ve species of this genus, occurring in Celebes, the Philippine Islands, etc. It is brown, with olive tints over the body, tints on the face, forehead and back sad. The tail is destitute of hairs, but a tuft at its tip.

SUS, Asia Minor, an ancient city, the capital of the Roman province of the same name, is now in the Turkish province of Adana and of the Mediterranean. It was once adorned by a number of magnificent buildings. Its inhabitants enjoyed the privileges of Roman citizens, and the city rose to inaction as a rival Athens, Antioch and Rome in wealth and grandeur, as well as in arts and sciences. It is the birthplace of Julius Caesar. It was situated on both banks of the Euphrates, which flowed into a lagoon con-tinental in the sea, which formed its port, and later, a harbor. Its origin is ascribed to Sar.-etas. It was early colonized by the Phoenicians, and it is thought to have been a great and wealthy city. Tarsus was colonized by Cyrus in his expedition against the Persians, and partially plundered by the Gauls. It yielded to the absence of the empire of the Seleucid, but was of the same state with Egypt under the Ptolemies. Pompey made Cilicia a province. Out of compliment to the Seleucids by gift of its name to Julii. It was plun-

TARTUS (in anatomy). See Anatomy; Foot; Osteology.

TARTAGLIA, tär-tal-yā, Nicola, Italian mathematician: b. Brescia, about 1500; d. Venice, 13 Dec. 1557. His family name was Fontana and he was given the name of Tartaglia, the stutterer, from a defect of utterance contracted during his neglected childhood. From the year 1530 he taught mathematics at Verona and Vicenza, was appointed professor of mathematics at Brescia and in 1534 was called to the same post in Venice. He discovered the method of solving the cubic equation containing the 1st, and 3d powers of the unknown quantity, and in repeated contests with the ablest mathematicians of his time defeated them and was able to solve all their problems, while his own remained unsolved. In 1539 and 1540 Cardan, under the promise of strict secrecy, obtained from him his discovery, and afterward, in violation of his promise, published it in his Ars Magna. This led to a violent controversy and a public mathematical contest, in which Cardan was worsted, his townspeople raised a mob and prevented a continuance of it. But the solution is still known as Cardan's rule. His chief work is 'Generale trattato de' numeri et misure' (1556). He also published a treatise on gunnery, 'Novella Scienza,' which has been translated into English by Lucear; the first Italian translation of Euclid; and seven or eight other mathematical works, the best known of which is 'Questi ed invenzioni diversi' (1559).

TARTAN, the typical Scottish plaid; a thin worsted cloth having alternate bands of different colors, forming a checkered pattern, which has been highly specialized by Scotch weavers for the dress of the Scotch Highlanders, each clan having its own peculiar pattern. The well-known Stewart tartan is scarlet in the centres, with dark blue, green, and white lines and wide-spaced dark independent lines. An endless variety of fancy tartans are now manufactured, some of wool, others of silk or mixed material. The term is also applied to the checkered patterns themselves.

TARTAR. See Arbol.

TARTARAGA, a South American turtle of the family Pelomedusidae; specifically the great "arru" or river-turtle (Podocnemis expansa) of the Amazon Basin, the female of which has a shell sometimes measuring three feet in length. This turtle is of great commercial importance throughout northern South America, on account of the eggs, which are periodically collected from the sand banks where they are buried by the river, chiefly for the oil to be pressed from them. This is either eaten, like the eggs themselves, or is burned in lamps alone or mixed with tar. The turtles are likewise eaten by man and many animals.
TARTARIC ACID—TARTARIN

TARTARIC ACID, Dihydroxysuccinic
CHOHCOOH
Acid, | exists in four stereoisom-  
CHOHCOOH
eric modifications; these are known as (1)  
Dextrotaartaric acid, or Ordinary tartaric acid,  
(2) Levotartaric acid, (3) Racemic acid and  
(4) Mesotartaric acid.

1. Dextrotaartaric Acid and some of its  
salts are widely distributed in the vegetable  
kingdom, its acid potassium salt being present  
in large quantities in grape juice. When grape  
juice is fermented, the acid salt, being only  
sparingly soluble in the alcohol produced, forms  
a dirty-white crust or sediment in the fermenta-  
tion casks; this deposit is known as "argol" or  
"lees." Cream of tartar and ordinary tartaric  
acid are usually obtained from this source.  
For the preparation of cream of tartar, argol  
is simply freed from impurities by treatment  
with animal charcoal and by subsequent crys-  
tallization. For the manufacture of ordinary  
tartaric acid, argol is boiled with dilute hydrox-  
ed potassium acetate, and then precipitated as calcium  
tartarate with calcium hydroxide. The yield  
is increased by adding calcium chloride to the  
mother-liquor. From the calcium salt thus pre-  
cipitated tartaric acid is liberated with dilute  
sulphuric acid.
A number of synthetic methods are also  
in common use for the manufacture of tartaric  
acid. According to British Patent 12,467, the  
compound may be obtained by the elec-  
trolytic reduction of glyoxylic acid or its  
deuterated glyoxylic acid and then precipitated  
as calcium tartarate with calcium hydroxide.  
The yield is increased by forming oxalic acid  
by the action of amalgams. The method of  
L. Baeckeland (United States Patent 1,190,845)  
consists in building up the acid from the oxides  
of carbon by converting them into formates;  
from these, oxalates are obtained at high  
temperatures and pressures; the oxalates are  
reduced to glyoxylates, and the latter electrolyzed  
to tartarates. Tartaric acid has also been  
obtained by the oxidation of carbohydrates in  
the presence of catalyzers (British 108,494).

Dextrotaartaric acid crystallizes in trans-  
parent prisms, free from water of crystallization.  
It melts at 170° C.; above this temperature  
it yields pyrotaartaric acid, acetone,  
acetamide and other decomposition products.  
It is very soluble in water and alcohol, but  
insoluble in ether. In aqueous solution it turns  
the plane of polarization to the right, reduces  
ammoniacal silver compounds, is readily de-  
composed into glyoxal and other products in  
the presence of uranium salts, and yields large  
quantities of carbonic acid and acetamide  
in the presence of mancanese dioxide at or above  
35° C. Under the influence of ultra-violet rays  
tartaric acid evolves carbon dioxide. The  
crystals of the acid show triboluminescence.  
In the form of its acid potassium salt the com-  
 pound has been used by the ancients. The pure  
acid was first described by Scheele in 1769.

2. Levotartaric Acid differs from the dext-  
roatartaric in that it turns the plane of polarization  
to the left. It was first prepared by Pasteur from sodium  
ammonium racemate. When this salt is allowed  
to crystallize it deposits two sets of crystals from  
which dextrotaartaric and levotartaric acids may be  
obtained. Pasteur's observations showed in-  
"Tartarin de Ty" (1872), "Tartarin sur les Alpes" (  
"Port-Tarascò" (1890) present Daudet  
remembered characterization, a typical Provençal  
man of the Midi, such as he has been described in speaking of his other novels of the South, Numa Roumestan: "...the theatrical, living parade, costume, situation, colour, blazing, triumphant, emotional, caressing, feline, with an eloquent, excited yet colorless, quick to yet giving anger a sham expression even if it is sincere." Looking back on in the years that followed since, it occurred to me that "Tartarin" has qualities of vitality, truth,—a truth from over that may swell and exaggerate facts, really lies."
This presentation of "truth from humorous side," in the phrase of Daudet's
TARTARS—TARTE

TARTE. See Tatars.

TARTARUS, târ-târ'ûs, according to classical antiquity, a deep pit which extends under the surface of the earth as completely as heaven extends over it, holding within closed portals Kronos and the Titans in their punishment. It was the jail established by the mythical gods for those whom they had driven from the supernal world, just as Erebus was a similar prison for men. Later the term came to signify the whole underworld in which the wicked undergo the punishment of their crimes, the exact opposite to the Elysian fields, the afterworld of the good. Tartarus, as a personification, is the son of Æther and Ge (air and land), and father of the giant Typhoeus by his own mother, Ge. 

TARTARY, târ'târ, or TATARY, a name applied in the Middle Ages to the countries from which the Tartars came or in which they lived, that is, central Asia and what is now southeastern Russia, western and eastern Turkestan, Mongolia and Manchuria. In a narrower sense it includes only southeast Russia and Chinese Turkestan.

TARTE, târt, Joseph Israel, Canadian statesman: b. Lanoraie, Quebec, 11 Jan. 1848; d. 1909. He was educated at L’Assumption College, was a member of the Quebec assem-

TARTARS. Zola, developed out of observa-

tions of the Midibô from the subtle

effects of Gascon temperament in 1872.

The

was begun in 1868, but this "cinematographic" first showed its sublunary atmosphere of the Rimbaud's self-deception. "Of a man who had lived going unhappily in one of the few who had been there,"

In his favorite reading of the local color for the self-deception of his own life, he became the victim of the false sense of identity with his fellow-men. The Quixote in him says exclaimed: "I go!" the Sancho: "I go!" Tartarin cover yourself with glory!" Quixote. "Cover yourself with filth and mud, Tartarin, who dreamed of daring deeds in lands, till he was 45 had never slept his own home town. The Quixote in him says: "Give me a toma-

cries Quixote. "Jeanette, my chocolate,"

nacho. A lion seen at a circus fires his sails all the way. He must go to Africa to attain his self-esteem and reputation at Elaborate preparations keep his fantasy real till he sets out for Algeria. And disillusion follow, in amusing such his landing in exotic equipment among Europeanized denizens of Algiers. Tartarin's animal propensities for a he shoots a donkey for a lion, where are the customary game, beguiles him. Tartarin is beguiled with Oriental pleasures, is to his Quixotic self by a paragraph in jest. In his face resolutely south-

counters a tame and blind lion, imagines fired at another, is robbed by his com-

an alleged prince, shoots the tame lion burns with a melancholy camel, whom he abandoned to his own fate, and who re-

stay lost, much poorer in purse but earned the privilege of dazzling his fel-

men with tales that he, confirmed by 1 of the tame lion, himself half believes are.

ends this delightful bit of Provencal ge. Often, as obvious, it graces the me, but is always saved with unfailing me more buffoonery. In Tartarin on s' the spirit and method are the same, it is all a little mellower and more It is reinforced by the Midibô's more readily appreciated, as he is more generally familiar. The public critics join in pronouncing it the piece of French humor in the 19th cen-

The opening scene where Tartarin, equipped as for the Himalayas with ice-axe, climbing irons, snow-glasses and the rest, makes his entry into the patrician hotel on the Rigi, with its 600 very prosaic tourists, is unforgettable; so, too, is the tale of Tartarin's hunt of the tame chamois, trained to attract strangers and fed in the hotel kitchen. The Swiss Exploitation Trust, created in the spirit of the en-
ily in 1877-81 and was returned to the Canadian Parliament for Montmorency in 1890. He was again re-elected in 1891, as a result of his insistent attacks in the administration of Macdonald, whose ministers he charged with corruption, but in 1893-96 was member for L'Islet. He was later, under the Laurier administration, Minister of Public Works, and his editions at Montreal, Le Cultivateur, and La Patrie.

TARTUFE, a comedy of Molière in five acts in rhymed verse, the first three acts of which were presented for the first time before the king and queen at Versailles, 12 May 1664, when the author was 38 years old. The play made enemies everywhere. There were those among the Jansenists and Jesuits who each thought that the others were aimed at, and a violent attack was written by the curate Pierre Rouillé under the title Le Roy glorieux et menteur (Paris 1664), which upon Molière's protest was censured by the king. The latter nevertheless forbade the play to be presented again until finished. On 5 Aug. 1667, a second version of the play was presented at the Palais Royal under the title L'Imposteur. Molière, apparently upon the suggestion of the papal legate and his entourage, had softened it in several respects; for instance, the original Tartuffe was no longer in ecclesiastical garb. Nevertheless, its presentation was stopped, in the king's absence, by the first president of Parliament and interdicted by the archbishop of Paris. The king, despite his prohibition, had shown his favor by taking Molière's players under his patronage in 1665. It was only on 3 Feb. 1669, however, that a third version, the only one known to us now, was acted at the Palais Royal by the king's permission under the original title, and the poet's long years of waiting for a hearing were rewarded by extraordinary success. The plot of the play, which is masterly in its simplicity and logic, concerns the entrance of one Tartuffe (or Tartufe or Tartuffe), a self-seeking adventurer hiding his greed behind the mask of piety, into the house of Orgon, a well-to-do landowner. Orgon, who has been affianced to Valère, Orgon (played by Molière) and his opinionated old mother, Madame Pernelle, fall completely under the sway of Tartuffe over the protest of the rest of the family, including a rather hot-headed son, Damis, and a sensible and even-tempered brother-in-law, Cléante. Orgon goes even so far as to make a deed of gift to Tartuffe and to promise his daughter to him, despite a previous promise to Valère. It was not on the daughter, however, but on Orgon's second wife, Elmire, young and comely, that Tartuffe had cast longing eyes. To save her step-children, Elmire (played by Molière's wife) consents to lure Tartuffe into an avowal which her husband may overhear. This scheme being successful, the impostor throws off the mask and impudently claims the house under the deed of gift. Orgon's ruin is narrowly averted by the intervention of Louis XIV, a very evident device to which Molière restored the house to Orgon and hales the villain off to prison. It is not only for the singularity and boldness of the subject or the skill in which it is treated that this play merits approval. The first scene is as it is new, as full of simplicity as it is bold, and so commonly made use of in old grandmother, offended at what amiss in her granddaughter, is inflicting a severe lecture to those who blame her house, in which she draws the censure from all; for we distinguish through the language of prejudice this moment everything is in motion. Actually it gradually increases to the end. The coolness of Dorine (played by Marie Martin), a maid, in the scene with Tartuffe gives us a clear view of Orgon and his devotion. Tartuffe, who is only an actor in the first two acts, makes his appearance in the third, when the plot being so animated receives equal vivacity. The schemes employed against this villain are the address with which he turns away. The infatuation of Orgon, which in proportion to the title L'Imposteur was given occasion to that singular and singularly acted scene of the fourth act, which the perfect unmasking of a vice so abominable as that of hypocrisy renders indispensable. The sarcasm of Louis XIV, put in the mouth of the character of Tartuffe, exempt at the end of the play, could not be faulted by the unravelling in the eyes of the critics. Here indeed is the insuperable defect. It is impossible to set on the religious hypocrite and not lend him the language of piety. Consequently it appears that the mask of religious hypocrisy necessarily take on the occasion a character on religion itself. This was of the opposition to the play, and in a measure justified it bore out the consequence of 'Tartuffe' by an aggressive force. The translation of a part of this work is of Molière's: John Watts (London 1748).

Herbert F. V.

TASCHEREAU, tash'ur, Sir, Canadian jurist: b. 7 Oct. 1861-67 he sat in the Canadian Assembly representing Renne C. 1871 he was appointed judge of Superior Court, and (1878) judge supreme Court of Canada. He knight in 1902 and from 1902-06 justice of the Supreme Court of Can.

TASCHEREAU, Jules Antm, author and politician: b. Toux, Paris, 11 Nov. 1874. He studied at the Sorbonne, entered journalism, and in 1897 he entered the Chamber of Deputies. Meantime he had established himself as a journalist. Rene Pari was among the early supporters of l
TASHKEND — TASMAN

and after the coup d'état was rewarded post of assistant director of the Na-
vari. In 1858 he was given the chief
ship of the Gomarakan, literary work
of critical biographies of Molière,
and Diderot.

H KEND, tash-kend', or TASH-
Asia, the capital of Russian Turkestan
province of Sir-Daria, formerly in
ate of Khokand, a few miles from
and about 40 miles from its
with the Sir-Daria or Jaxartes,
le oasis. It is the most important
Aasian Russia, and is at the termi-
the Transcaspian Railway, with di-
route to the Caspian Sea and to
consists of an old town and an
ian quarter. Its former walls, which
miles in circuit, are now in ruins.
its in the old town are very narrow.
ver, in consequence of the crowding
uses, but of the number of gardens
is with the Sir-Daria or Jaxartes,

The Russian district of the city
streets lined with trees, electrically
id traversed by trolley lines, and
nasia, a public library, observatory,
with the Sir-Daria or Jaxartes,

The inhabitants
ved in weaving silk and cotton goods,
icles in leather and felt, etc. The
corn, cotton, rice, etc., is very

Tashkend was taken by Russia in
ut one-sixth of the present population
Russian.

5, The, a descriptive poem written
Cowper (q.v.) in the summer of 1783,
shed two years later in a volume con-
so "An Epistle to Joseph Hill, Esq.," 2
im, and "John Gilpin" (q.v.). It is

The Task, a poem with the same title
ving Milton a bit too plainly, and it
uted into six books, the aggregate
of lines being somewhat over
the metrical form, and the theme
he begins, "the sofa," are said to
ken by the poet from Lady Austen,
told him the story of "John Gilpin,
title commemorates the fact that in
we was obeying her injunction. The
the descriptions of which have per-
more than anything else to make the
classic standing not far below the
orate poems of the language, is that
in Buckinghamshire, and the neigh-
heeston. "The Task" set the seal on
popularity with his own generation
ceeding, and without it, despite

In his earlier pieces, notable in
range, he would perhaps not rank so
poet to-day, although it is to be
it too many readers know his mastery
through quotations, such as "God
made the country, and man made the town."
"With the spirit of life," the cups
of the spirit but not imbibe, and the
the, or else through selections such as the
pathetic description of "Crazy Kate," or the
national "England, with all thy faults I love thee still,
or the picture of the postman outside in the
winter evening, while all is domestic comfort
within, or the poignant bit of autobiography
that begins I was a stricken deer."

The
desultory and somewhat spun out "The Task" with
its longueurs, its exhibitions of intellectual
narrowness and religious bigotry, its comparative
lack of high and sustained imagination,
should tempt to skimming and even to tast-
ing by selections does not afford matter for
prise; yet the admirer of Cowper and the
student of English poetry must contend that
so to treat "The Task" is to stand in one's
own light. The ease and skill of the
transitions make the very desultoriness of the
poem an exhibition of art, Cowper an artist; but
west is still perhaps the most urban of our poets,
the descriptions of sceneries are scarcely
prized, as etchings in words, whether by
Thomson or by Wordsworth, and, although
there is little of the latter's philosophic insight
the heart of nature and into that of a man,
there is in compensation the absolutely sin-
cere expression of the observations, reflections
and emotions of a sensitive poetic genius un-
spoiled by literary or social sophistication.
When in addition we think of Cowper's play-
ful humor, his feeling for domesticity, his hu-
mankind, his satiric power — witness the
passage on the excise in the fourth book —
as exhibited in "The Task," we are led to
wonder whether our great-grandfathers
in their hearty appreciation of the poem as a
whole were not wiser than we are in our res-
ervations and in our glib phrases with regard to
Cowper's services as a precursor of the Geor-
gian romantics.

WILLIAM P. TRENT.

TASMAN, tás'mán, Abel Janssen (Jans-
zén, Janzoon), Dutch navigator: b. Hoorn,
North Holland, about 1602; d. Batavia, Java,
October 1639. He was engaged in the
 discovery in the Pacific and Indian oceans in
1638-42 under the patronage of Van Diemen,
 governor-general of the Dutch West Indies,
and in the latter year was sent to circumnavi-
gate Australia. He sailed from Batavia 14
Aug. 1642, discovered, on 24 November the
island which he called Van Diemen's Land, but
which has since been named Tasmania, and
later discovered the southern island of New
Zealand, the Friendly Islands, and the Fiji
Islands and returned to Batavia 5 June 1643.
Details concerning a subsequent voyage along
the coasts of New Guinea and north and west-
ern Australia are exceedingly scanty. He
set out on 29 Jan. 1644, discovered the Gulf
of Carpentaria, made other important dis-
coveries, and returned to Batavia, but further
information is lacking. He was one of the
great navigators of the 17th century.
He published a narrative of his first voyage
which was reprinted in 1722 and in 1860. Con-
sult his "Life" by Walker (Hobart, Tasmania
1896).
TASMAN (táz·man) SEA, Oceania, that part of the Pacific Ocean lying between Tasmania (and southeast Australia) and New Zealand. It is 1,500 miles across, and is crossed by a submarine cable from Sydney to Wellington.

TASMANIA, táz-ma´nit-a, Australia, the smallest state of the commonwealth, consisting of the island of Tasmania and its adjacent islets, and situated 140 miles south of the southeastern extremity of the Australian continent, from which it is separated by Bass Strait. The area of the state is 26,385 square miles, and of the main island 24,339 square miles. The main island is heart-shaped, about 180 miles long from north to south, and 175 miles at the widest. The coasts are bold and much indented, forming a number of excellent harbors. The interior is a plateau intersected in various directions by a number of rough and precipitous mountain ranges, rising in Cradle Mountain to a height of 5,069 feet. Some of the intervening basins contain large and beautiful lakes, and rivers are numerous. The geology is characterized by considerable outcrops of phaneritic rocks and extensive flows of tertiary basalt. The mineral wealth is great and mining is the principal industry. The annual value of mineral products is about $4,000,000, mostly gold and tin. The imports in 1916 totaled nearly $5,000,000 and the exports less than $4,000,000. The largest farm crop is oats, 2,000,000 busheled annually, wheat following with 1,000,000 bushels. The climate is temperate, and the rainfall in general sufficient. The flora and fauna are similar to those of southern Australia. There are two remarkable animals peculiar to the island, the Tasmanian wolf and the Tasmanian devil (Thylacinus and Dasyurus), sometimes called the native tiger. The soil is very fertile, especially in the basaltic regions, and well adapted for wheat, which is the principal crop. Grazing has declined, and the manufactures are inconsiderable. The volume of trade amounts to over $800,000 annually. The chief exports are copper, fruits, silver, wool, tin, gold, timber, hides and grain. Hobart, the chief port on the southeastern coast, has regular steamship connection with Europe, Australia, and New Zealand. There are about 600 miles of railroads. Education is compulsory. There are 16 colleges, and at the head of the educational system is the University of Tasmania. The capital of the state is Hobart with 38,000 population.

Tassero was discovered in 1642 by the Dutch navigator, Tasman, who named it Van Diemen's Land, after his patron. In 1804 England established a penal colony on the island. This was maintained until 1853, when Tasmania was declared a British colony. In 1900 it became a state of the commonwealth of Australia. The aboriginal inhabitants are almost extinct. There is a remarkable regular shifting of the population between Tasmania and Southern Australia, more than 40,000 emigrants and over 40,000 immigrants being officially recorded every year. Consult "Statistics of Tasmania" (Hobart, Australia). See Australia.

TASMANIAN WOLF, DEVIL, ZEBRA-WOLF, etc. See DASYURIDAE.

TASSAERT, tā-sār´t, Nicolas F. Octave, French painter; b. Paris, 1800; by suicide, 1874. He entered the studio of Girard and L�therie and made it his artistic aim to portray "Les Misérables" of Paris—the poor, the suffering, the wretched—his life. The exaggerated sentimentality of his pictures was much admired at the time. realism appealed even to Delacroix and Puvis. Among his best-known works are "Old Musician," "A Family of the Jews," "The Slave Merchant," and "Les Détroits." 

TASSIE, tāz´i, James, English engraver; b. Pollockshaws, near Glasgow, 1735; d. London, 1 June 1759. During his life he worked as a stonemason, then as a goldsmith, and later as an engraver. He was associated with Dr. Quin in gem engraving and his work, copied many of the most famous gems of ancient and modern times, and he made a series of large medallions for a number of the famous men of his time. Medallions are of great historic interest and considered his most valuable work.

TASSO, tās´so (Eng. tāz´o), B. Italian poet; b. Venice, 11 Nov., 1495; d. Padua, 5 Sept., 1569. His education was at Padua, where he studied medicine and music. He went to Rome where he studied law. His learning, took him into his service and employed him in negotiations with Clemente at Rome and Francis I in France. He gained the friendship of the Pope and the King of France. He was sent on public business to Spain and married the rich, beautiful and intelligent woman Porzio de Rossi, and retired to Sorrento, where he lived until 1547. He was made a knight of Malta and his life was spent in study. He was Charles V on account of his opposition to the Netherlands, the Introduction into the Inquisition into the Compelled poet, at the invitation of the Duke of Urbino, to take up his residence in Pessaro. The leisure which he now enjoyed, he employed in finishing his "Amadigi," which he published at Venice in 1560. In 1563 he was appointed the Duke of Mantua's ambassador to Spain. He was buried at Mantua, where he monument erected by the duke, with the inscription "Ossa Bernardi Tassae," by Torquato. Torquato afterward removed his body to Ferrara. His chief work is "Liber de Saula," a romantic epic, displays his power in art. His other works, in five volumes, are among the best Italian lyric and elegiac of the time. Consult Passoni, "I Greci di Torquato Tasso" (1885).

TASSO, Torquato, tōr´kwa´tso, preceding. Italian epic poet; b. Sorrento, 23 March 1544; d. Rome, 25 April 1595.
TORQUATO TASSO
to the school of the Jesuits at Na-
dia father being absent from home, m was at first superintended by his
om he quitted at 10 years of age to
at Rome, and never saw her
this time he could recite from mem-
Greek and Latin poets. He sub-
ursued his studies under his father's
e at Rome, Bergamo, Urbino,
the Venetian. He was so inspired by his father to revise and com-
em 'I'Amadigi,' and eventually sent
to study law. Tasso, a born poet,
legal studies a sore burden, but mani-
time for more congenial pursuits,
to the surprise of Italy and the in-
f his father, produced the 'Rinaldo,'
12 cantos. The disappointment
eryielded at length to genuine ad-
this really remarkable production,
eceding to allow his son to abandon
literature. The reputation of the
meanwhile procured for him an in-
the University of Bologna, where
an aptitude for the study of phi-
peakers and ancient gems. He led a
account of a lampoon, which he was
arged with writing. After visiting
Castelvetro, Modena and Correggio,
d to Padua on the invitation of
Gonzaga. Here he continued the
lato, and wrote three 'Discorsi del sico.' He determined no longer to
osto but take Virgil for his model.
construct the plan of his 'Gerusa-
rm.' He determined at first called the
le plan of this poem was of a highly
character. By celebrating all the
pean houses as having taken part in
of Godfrey, he hoped to make him-
powerful friends, and while he was
this project he secured a patron in
iugì d'Este, to whom he had dedi-
Rinaldo. The princes of Italy at
deemed it their chief honor to be
peons of art and literature, and
ained gentleness in his rot-
of whom was Tasso, who was also
by the cardinal to the court of Fer-
academy of Ferrara supplied learned
him who engaged in philosoph-
ions: the courtiers were easily trans-
paladins, and the court ladies into
whose imaginary achievements the
led with daily diligence. Thus the
me' grew at the court of Ferrara.
ging might be wanting to his experi-
card engaged in a course of love-
his own account. There were at the
ferrara two sisters of the reigning
zia, the wife of the Duke of Ur-
conora, the younger, a virgin of 30,
ten years his senior. Their brother
ed to the poet as model for his
'm High favor with the ladies, by
attentions were received as the gal-
 courier and a poet, it would be to
ministerial man and the man of
id now become. In 1571 he accom-
cardinal on an embassy from the
Charles IX of France. He was re-
d distinction at the court of France,
allowed to Blois, Tours and Chenon-
seard (q.v.) received him in the most
friendly spirit. A quarrel with his patron
drove him from the French court, and he
returned to Ferrara, where Alfonso, at the solicita-
tion of his father, conceived a
into his own service. In the spring of 1573 his
'Aminta,' a pastoral drama, was represented at
the court of Ferrara. It is still considered
the most graceful Italian work of the kind, al-
though many prefer the 'Pastor Fido' of
Guarini. In April 1575 he announced the com-
pletion of the 'Gerusalemme.' Alfonso
was eager for its immediate publication, but this
judicious counsel was not heeded by the poet,
whose sensitive mind dreaded censure, especially
the censure of the Church, even more than it
 coveted applause. He, therefore, sent his poem
to his friend Scipio Gonzaga, now a cardinal
at Rome, requesting his judgment. Scipio as-
sembled a consulta of churchmen and critics
against whose censures, literary and ecclesia-
tical, the poet was forced to defend himself and
to amend and modify his work to meet their
views. He was told he ought to be content
with monks and nuns as his auditors, and to
renounce all mythology, romance and chival-
rous adventure, and his mind, divided between
art and religion, gave way. To add to his dis-
traction his work at this time was printed pi-
 ratically without his own revisions. Alfonso
wrote a vigorous protest against this disgrace-
ful proceeding to all the Italian courts, but
his doubts of his favor at court began also to fill
the mind of Tasso. He believed that he was
persistently calumniated at court, and systema-
tically misrepresented to the Inquisition. On
17 June 1577, he drew his pen in the apart-
ment of the Duchess of Urbino. He was ar-
rested, but set at liberty after two days and
recommelled to retire to his country-seat. In
spite of strong reassurances he still suspected
the office at Rome. He was now received into
the convent of Saint Francis at Ferrara, but
on the 20th July he started in disguise for his
native place where he stayed with his sister
Cornelia, till the end of summer. In the
autumn he solicited leave to return to Ferrara,
and obsequiously accepted a condition that
was essential to his request. Alfonso is accused of
imprisoning him, first, from offense at the add-
dresses paid to his sister; secondly, from jeal-
osy of the Medici, from whom the poet had
received an offer; and thirdly, from a fear that
the poet would strike the glory of the house of
Este out of his work. For some years Tasso
had lived on intimate terms with Alfonso and
his two sisters, especially Lucrezia, who, dis-
missed by her husband, kept him as her con-
temporary companion. He had hesitated about ac-
cepting the offer of the Medici, but in 1557 he
put away, out of gratitude to the Este family,
all thoughts of other service. After many
complaints of ill-treatment he again left Fer-
rara, and wandered, sometimes in want,
through Padua, Venice, Urbino and Piedmont,
and finally returned to Ferrara (21 Feb. 1579),
on the eve of the duke's second marriage.
Finding himself treated with complete neglect,
he broke out in loud complaints and was ar-
rested as a madman in the hospital of Saint
Anne of Ferrara. At this time his work was
condemned by the Academy della Crusca, to
whom he replied with moderation. He re-
mained in the hospital of Saint Anne till July
1586, when he was released at the solicitation
...
of Vincent di Gonzaga, who took him to his estates. Tasso now resided at Mantua, and was requested by order of the court to write a genealogical poem he dedicated to Vincent di Gonzaga. Finding that Mantua did not agree with him, he proceeded to Naples, the climate of which he found most congenial, and where he fixed his favorite residence at the monastery of San Salvatore. Here he composed the "Gerusalemme Conquistata," which he dedicated to Cardinal Aldobrandini. It is a reconstruction of the "Gerusalemme Liberata," in which he rejects the chief mystical and chivalrous ornaments of the previous poem, and plumes himself on a precise and slavish imitation of the "Liad." He wished it to supersede the "Liberata," but posterity has reversed his decision as to its superiority. Aldobrandini solicited and obtained from the pope an indulgence on behalf of Tasso. Urged by his patron, Tasso repaired to Rome, although he declared it was to die. Amid the preparations for the ceremony, his health gave way. He retired from the plaudits of the public to the consent of Santo Spirito (Aminta; Jerusalem Delivered). Tasso's chief works include "Gerusalemme Liberata," the "Rime," and the "Aminta." The "Gerusalemme" was translated into English by Edward Fairfax in 1600. In Italian literature the "Gerusalemme shares with the "Orlando" of Ariosto the place of the greatest epic. Both are full of poetic beauties and admirable for the interest and variety of the narrative. Consult Albertazzi, A., "Torquato Tasso" (Modena 1911); Boulingu, W., "Tasso and his Times" (New York 1907); Milman, R., "Life of Tasso" (2 vols., London 1880); Ferruzzi, E., "Tasso, studi biografici e critici" (1880); Serassi, A., "La vita di T. Tasso" (3 ed., with notes by Guasti 1858); "Complete Works" (3 vols., Pisa 1821-32); Tasso's "Lettere e Dialoghi," edited by Guasti (Florence 1852-59); "Prose diverse" (1825); Solerti, A., "Vita di Torquato Tasso" (3 vols., Turin 1885); de Sanctis, F., "Storia della letteratura italiana" (2 vols., Paris 1912); Sainati, A., "La briga di Torquato Tasso" (Oplonti 1912); Scopoli, "Le fonti del mondo creato di Torquato Tasso" (Naples 1907); Wagner, Hedwig, "Tasso daheim und in Deutschland" (Berlin 1905); Woodberry, G. F., "The Inspiration of Poetry" (New York 1910).

TASTE, in aesthetics, appreciation of the beautiful; the faculty of discriminating the qualities of beauty, harmony, etc., and exercising them, particularly in art, and literature, jointed to a capacity for appreciating and enjoying excellence. See AESTHETICS.

TASTE. See SENSES.

TATARS, or TARTARS, a nomadic people generally spoken of as Scythians, known for their invasions and conquests among neighboring nations over a wide extent of territory; their local seat being found both in ancient and modern times in the steppes or uncultivated regions which were afterwards as well as at the north of China, in Turkestan and on the shores of the Caspian and Black seas. Tartar, Tatar or Tart appears to have been the name of a tribe of Mongols who occupied about the same district of China Tartary on the upper Amur. This tribe was dispersed by the attacks of neighboring Mongols, among the terror of its arms in different parts of Asia and Europe, and gave rise to various hordes of Mongol robbers. The Tatars formed part of the hordes of the Ogorkh Khan, when that conqueror carried with him the country known as Chinese Turchia, and according to some accounts the name to be applied to the Mongol horde, as well as to the hordes of similar origin who followed the footsteps of the Tartars, and settled in the districts from which they came, or in which they settled; hence the name "Tatar," transitory, for a Mongol robber. See Amur, Turkestan, and Little Orenburg, Astrakhan, Ekatereinoslav, the sack provinces and the Crimea.

TATE, tâ, Alexander Norman, analytical chemist: b. Wells, Somerset, 1837; d. Orton, Cheshire, 22 July 18. He studied chemistry in Liverpool, where he published an analytical and consulting laboratory in 1863, and the results of industrial science in connection with the study of the recently introduced petroleum. He wrote "Petroleum and its Uses" (1863), and superintended the planning and management of oil-refining works in the Isle of Man and in Flintshire until he finally settled at Hackins Hey and became an expert in the analysis of fats, and as a teacher of science technical schools at Liverpool. He was editor of the scientific magazine Regress (1864-70) and a contributor to scientific periodicals.

TATE, George, English archaeologist: b. Alnwick, 1805; d. there, 1871. He was a linen draper and sub-postmaster of his native town and became, for his scientific researches and publications. These include: "The History of the Antiquity of Graveshall"; "The Hut-circles at Yevington Bell;" among the long list of his papers on the ancient remains of the city, its geology, flora and fauna, and tured Rocks of Northumberland and Borders," (1865) and "History of . . ." (1865-69).

TATE, Henry, English merchant: b. Chorley, Lancashire, Streatham, 5 Dec. 1889. He was a merchant in Liverpool and amassed a fortune through the invention of leaf sugar. He moved to London in 1880 and became known as a benefactor, giving £42,000 to the University College, a still larger sum to the hospitals and four free beds to the parish of Lambeth. He established a private gallery of modern paintings and art, and afterwards presented it to the building for the collection a gallery of pictures at Tate Gallery, where it was opened in 1897, and its donor was created a baronet, known as the "Tate Gallery."
TATE — TATTOOING

The Tatler was succeeded by The Spectator (q.v.).

TATTERSALL’S, tät’är-sällz, located in Knightsbridge Green, London, England, is the great metropolitan mart for horses, of which there is an auction every Monday throughout the year and every Thursday in spring. It has acquired greater celebrity as the head-quarters of betting men.

TATTI, tät’te, Jacopo. See Sansovino, Jacopo.

TATTNALL, tät’nål, Josiah, American naval officer: b. Bonaventure, near Savannah, Ga., 9 Nov. 1795; d. Savannah, Ga., 14 June 1871. He was educated in England and in 1811 returned to the United States. He was appointed midshipman in the navy. He was engaged in the battle of Bladensburg and served in the Algerine war in Decatur’s squadron. He was promoted lieutenant in 1818 and was engaged in the suppression of the West Indian piracy under Porter in 1823-24. He was promoted commander in 1838, placed in charge of the Boston navy yard and at the outbreak of the Mexican War was assigned to the command of the Spitfire and joined the squadron at Vera Cruz. He took charge of the Mosquito division, with which he covered the landing of General Scott’s troops, and after the fall of Vera Cruz led the attack on the forts at Tuspan. He became captain in 1850 and in 1857 was appointed flag-officer of the Asiatic squadron, where he participated in an attack with the French and British on the Chinese. Although a violation of neutrality, he was sustained by public opinion and also by the government. In 1861 he resigned from the United States navy and offered his services to the governor of Georgia. He was appointed captain in the Confederate navy, took command of the Merrimac after the engagement with the Monitor in 1862 and set out for Hampton Roads. After the surrender of Norfolk and the navy yard he withdrew with the Merrimac, and on 11 May 1862 to prevent her capture sunk her off Craney Island. The court-martial, which he requested, after a thorough investigation acquitted him from all blame. He then engaged in the defense of Savannah River, but in 1865 was compelled to destroy his vessels. In 1870 he returned home and was appointed inspector of the port of Savannah, a post which he occupied until his death. Consult Jones, C. C., ‘Life of Commodore Tattnall’ (1878).

TATTOOING, a word of Polynesian origin, anglicized from the Tahitian iatu, denoting the practice of making permanent designs or figures in the skin by means of small punctures or incisions, which receive various dyes or pigments. The coloring is mainly dark blue and dull red. A similar custom, known as cicatrization or scar-tattooing, consists in repeatedly cutting the skin at the same place so that in healing a raised scar is left. Both varieties of tattooing may be found among the same people, as in the case of the natives of the South Sea Islands. Among the Admiralty Islanders, the Fijians, the Gonds and the Todas of India, the inhabitants of the Liu-Kiu Islands and other races, color-tattooing is, or was, confined to the women, and the Latuka

shum, English poet: b. 1652; d. a Dublin clergyman, he was edu-

cated at Trinity College. In 1690 he succeeded poet-laureate. Oldys calls him I-natured, fuddling companion.*

t was survived through his metrical

t of the Psalms, which he wrote

me with Nicholas Brady, certain

which appeal to the reader, but

for the poetic value. He also

ic pieces, as ‘King Lear’ (an

Panacea or a Poem on Tea’;

Sacra; ‘Innocent Epicure’;

plement to the New Version.

ve been due solely to his pen, in

rid-renowned *While Shepherds

cribed to Tate.


philosophy and became dissatis-

fied with the systems of his time. At

50 he was converted to Chris-

 teachings of Justin Martyr (q.v.).

ning controversial work, Ad-

recks, 1 written 176 and after ulin Martyr he adopted Gnostic

christian conceptions regarding

urge and the world of souls, and

ence of contradictions in the

practical matters he rejected the

of animal food, and used only

ating the Eucharist. He was also

arriage, and he gave in his ad-

sect of the Encratites. He was

Tertullian, Clement of Alexan-

us, Origen and others. His

was a kind of harmony of the

In 1876 Dr. Moesinger published

Latin translation of a commen-

liatessaron which had been writ-

in Syriac. The translation had

414 by Aucher, a Mechitarist

the original Syriac of Ephraim,

text ant, but from an Armenian

ed to the 9th century. In 1891

d he Titian’s Diatessaron, in

t to restore the work from the

rials. An Arabic version found

ited in 1888 by Agostino Ciasco.

language of the ‘Diatessaron

Syriac; Harnack believes that

Consult Otto, ‘Corpus Apolo-

32’; Hampill, ‘The Literature

century’ (1891); Harris, ‘The

Titian’ (1890); Hill, ‘The Earl-

hrist’ (1893).

ťăšhi-śūs, Achilles. See Achil-

The, a paper published by Sir

in London, from April 1709 to

The name, Steele asserted, was

based on the venture of a pseudonym of ‘Isaac Bicker-

swift previously in his joke

anac-maker, Partridge. Its an-

dicated its purpose to present

gallantry, pleasure and entertain-

ment was the first to use the term

literature in English. Steele wrote

papers issued, Addison 41, and

produced most of the others.

*
of the upper Nile Valley are an example of a people among whom scar-tattooing is practiced. Color-tattooing is generally ornamental, but scar-tattooing is more frequently used to produce distinguishing tribal marks. The latter variety is practised by a number of native African peoples, while the Bangala of the Middle Congo scar the whole body for ornamental purposes. In some races there is a connection between tattooing and marriage. Thus, in the Solomon Islands a girl is not eligible for marriage until she has been subjected to an atrociously cruel process of tattooing on the face and chest, and the native Australians inflict fearful scars on the backs of their young girls before marriage. The Formosans tattoo the faces of girls prior to marriage; and among the Papuans of New Guinea unmarried girls are tattooed all over except on the face, which is adorned in this way at the time of their marriage. Color-tattooing of an ornamental kind reached its most artistic development among the Maoris of New Zealand and the Japanese, but both these peoples, like several others, have largely abandoned the practice under the influence of civilization. With the Malays tattooing appears to have been a reward of the successful head-hunter. Sailors and some other classes in civilized countries do this in order to distinguish themselves, and even in one color, making figures, as stars, flags, etc., on their heads, arms, chests, etc. Consult Robley, H. G., 'Moko, or Maori Tattooing' (London 1896).

TAUCHNITZ, town'shis, Christian Bernard, Freiherr von, German publisher; b. Schleinitz, near Naumburg, 25 Aug. 1816; d. 13 Aug. 1895. In 1837 he founded his well-known publishing establishment in Leipzig; in 1880 was created a hereditary noble; in 1886 was appointed consul-general for Great Britain in the kingdom of Saxony; and in 1877 was made a life member of the Saxony first chamber. The firm is best known for its collection of British and American Authors, generally called the "Tauchnitz Edition," begun in 1841 and in 1903 extending to about 3,700 volumes.

TAUCHNITZ, Karl Christoph Traugott, German publisher; b. Luckenwalde, Silesia, near Grimma, 29 Oct. 1761; d. 14 Jan. 1834. In 1797 he set up a printing shop at Leipzig, which he enlarged by the addition of a book-shop in 1798 and a type-foundry in 1800, the style of the firm being Karl Tauchnitz. He first introduced stereotyping into Germany, and won a high reputation by his musical publications, his editions of the Bible and the Koran and his remarkably correct series of Greek and Latin classics.

TAULER, tow'lur, Johann, German mystic; b. Strasbourg, about 1300; d. there, 16 June 1361. At 18 he denounced a fortune to enter the Dominican cloister, where he studied the scholastic theology, and returning to Strasbourg came under the influence of Master Eckhart, whose vernacular sermons then attracted throug his audiences. He was the more impelled to mystical and fervent piety by the violence of the war between Pope John XXII and the Emperor Louis the Bavarian, when the bishop of Strasburg forbad the clergy to open the church doors in the name of the so-called "friends of God," an unorganized brotherhood, including priests, nobles and burghers in all the large cities, who represented the heresy, denied the special prerogative of Christ, and contradicted the Scriptural precepts and with an acerbous spirit tended upon the worship in the heart and life. He preached with wonderful success in Str and in the neighboring towns, villages and cottages. Withstanding the papal interdict and the ravages of the black death (1348), he bestowed the consolations of religious consolation upon forsaken people, preaching in German rather than with Latin. He published in German a Life of Christ. Following the Lowly Life of Christ, he published a Remonstrance to the Clergy, leaving the dying unattended and unburied, and denounced ecclesiastical abuses while removing the claims of the electors. His onism, though it pronounced silence and led the most perfect work, was rather than passive, taught explicitly the love of to asceticism but to the amelioration of society. The discharge of the religious duties as a preparation for the development of spiritual perfection as an important duty, was the German theology which had been advocated by the pantheistic movements of F. C. Schmidt, 'Johannes Tauler von Straßburg' (1841); Winkworth, 'Life and Times of Tauler,' with 25 of his sermons translated from German' (1857); Junot, 'Les Amis de Dieu du XIVe Siècle' (1870).

TAUNTON, town, England, a port of Somerset, on the Tone, 36 miles south-southwest of Bristol. The principal buildings and institutions are the churches of Saint James and Saint Mary, and in the old grammar school, reconstituted as a Wesleyan Methodist and a Congregational College, a mechanics' institute, and a museum. The great antiquity, and from the discovery of containing Roman coins appears to have a Roman station. During the Civil War the city was of the Parliamentarians against the Royalists. The inhabitants suffered much from the rebellion of Monmouth, whose cause espoused, and who assumed the title of Prince here on 20 June 1685. Jeffrey (q.v.) was here in the same year.

TAUNTON, Mass., city, county, and county seat of Somerset County, at the head of navigation on the Taunton River, and about 36 miles southeast of New York, New Haven and Hartford road, about 36 miles southeast of New York, and 16 miles north of Fall River. There are some 2 steamers, which have daily connection New York and other places, are so near to that they practically. Taunton has a daily newspaper and about 100 freight cars enter the city daily. The Taunton River is with the Atlantic ports. The city gets its coal, lumber at tide water, and freight rates.
Taunton are less than for inland cities. Inns connect the nearby villages and the city, more than 700 cars leave of the city daily. Industry is noted for the extent and diversity of manufacturing industries. The government of 1910 gives the leading establishments of the city as follows: one bank, 161; insurance, 2; and 3,151 persons, to whom were paid $1,125,679. The cost of the material ally was $2,651,502, and the value of products was $4,592,466. There were 367 im and machine shops, with capital $2,679,203; the value of their yearly $2,636,360. The total number of manu- (1909) was 146; the total capital in 5,504,000; the average annual revenue, 7,855; the annual amount of $55,000; the cost of material used; and the value of the products, 1. The principal manufactures, bend products, are cutlery, machinists’ lads, tacks, nails, jewelry, machinery as manufacturers, silver and Britannia k, oil-cloth, copper and yellow metaling presses, stoves, stove linings and ensils. The city is the distributing a large part of Bristol and adjoining, coal is shipped from here to the i, the interior, and grain, vegetables, id manufacturers to outside markets. incipit public buildings are the State hispal, a massive group of buildings, a tract of 140 acres, which accommodates 1,000 patients; the county courthouse r: $300,000; Registry building (cost the government building ($100,000); Taunton jail; theatre; Odd Fellows’ storical Hall; Morton Hospital, the san Tillingham Morton Kimberly; Old sime, opened January 1871; club build- s, business blocks and. There are six each of Congregational Catholic churches, four Methodist, of Unitarian, Baptist, Presbyterian, Scientist, Adventist, Protestant Episcopal Universalist. The educational insti- Academy, opened 1 August Mary Academy (Roman Catholic); of the Old Colony Historical So- porated 4 May 1853; a high school, l parish schools, graded elementary sa public library containing about 70,000. The city is well supplied with the two national banks had, 0, a combined capital of $700,000; the surplus of two savings banks was and five co-operative banks had a capital of over $3,000,000. The gov- f the city is vested in a mayor and aldermen chosen by popular vote. Pop. 51.

— The first white settlement was by Elizabeth Pole, an Englishwoman, in 1630. There was an Indian village called “great river” on the Tectucutt River. Bought land from the Indians for on the east side of the river, present limits of Ward Four. The first called Cohasset, but when it was settled in 1639 it was called by its name, after Taunton, England. In June 1639 Taunton sent deputies to the General Court assembled at Plymouth. The name which appears on the Taunton records — early connected with the surveys and the granting of titles — are names of men who were among the history makers of the nation. The early settlers of Taunton recognized the rights of the Indians, and the records show that Miss Pole and others purchased lands from Massasoit and other Indians. William Hooke, the first minister, returned to England as domestic chaplain to Oliver Cromwell. The first mention of a schoolmaster is that of Master Bishop, who was one of the early settlers. Other schoolmasters were William Pole, Mr. Adams, James Green, and in 1683, Samuel Danforth, a minister, was selected to keep a “Grammar school here in Taunton.” In 1647 an act was passed which made the public schools free and the support of the schools compulsory. In 1682 Taunton received from the court £3 from the funds of the fishing excise of the Cape, for keeping a free colonial, classical and elementary school. In 1701-02 100 acres of land, on both sides of the river, were set apart for school purposes. The history of education in Taunton is an almost complete history of the city. A grist mill was erected in 1639-40; in 1653 the first successful iron works in America were established. Some of the products of the iron works were used as money, as may be seen from the following order:

To the Clerk of the Iron Works,

Ensign Thomas Leonard, please pay to Bar Tipping nine shillings and three pence in iron money.

From yr. friend,

Richard Williams,

Taunton 16th Jan. — 1685.

In 1659-60 a saw-mill was built, and before 1700 brick making, shipbuilding, and many other industries had been begun. The ruins and sites of many of the old manufactories are pointed out as of historic interest; for they mark the beginnings of the mighty industries of the Taunton of the present. On 6 Nov. 1746 the place was made a “shire town,” and on 2 Jan. 1863 was incorporated as a city. The first crucibles in America were made here; the copper blank discs for copper cents were supplied to the government, in large amounts, by the Taunton Manufacturing Company. Taunton has always furnished promptly more than its quota of soldiers when the country called for defenders. In 1774 the people unfurled from the liberty pole on “Taunton Green” a flag, on which was inscribed “Liberty and Union”; and among the “minnitt men” at Lexington, 19 April 1775, was a brave band from Taunton. They were among the first to go and the last to return. Robert Treat Paine, one of the signers of the Declaration of Independence, resided here, for whom a statue has been erected in front of the city hall. Consult Waterman, “History of Taunton School.”

TAUNUS, town of, Germany, a mountain range mainly in the Prussian province of Hesse-Nassau, extending eastward from the Rhine, north of the Main, separating the basin of that river from that of the Lahn. The highest summit, Grosser Feldberg, 2,280 feet in elevation. The district is well wooded, and ex-
TAURID A—TAVERNIER

hibits much picturesque scenery, as well as ruined castles, etc., and antiquities remain dating from Roman times. Its scenery and mineral waters attract many visitors; and some of the finest German wines are grown on the south side. The point of most historical interest in the region is the ancient Roman fort uncoverd at Saalburg, showing fortifications dating back to the year 200. West of Saalburg the Germans erected a colossal statue of Germania to celebrate their victory over France in 1870-71.

TAURIDA, tow're-da, a government of the Ukrainian Republic, bounded north by Ekaterinoslav; east by the Sea of Azov; south-east, south and west by the Black Sea; and north-west by the government of Kherson, from which it is separated by the Dnieper; area, 23,312 square miles. It is irregular in shape, and being united to the land only on its boundary with Ekaterinoslav for about 90 miles, may be regarded as one large peninsula, subdivided again into two minor peninsulas, of which that in the south, now called the Crimea, and well known in ancient times as the Chersonesus, is the more perfect; the island which constitutes it in the northern portion being at its narrowest not more than eight miles. The northern peninsula consists almost entirely of an extensive steppe, which stretches across into the southern peninsula, largely, as it is much cut up by innumerable lakes, and in many parts composed of parceled and saline sands, where vegetation is almost extinct; but in other parts is composed of fertile loams, capable of raising any kind of crop, and often covered with waving pastures. Simferopol is the capital city. (See also the article CRIMEA.) Pop. about 2,133,000.

TAURUS, târ'ús, Asiatic Turkey (or Asia Minor), a mountain chain or series of mountain groups usually considered as beginning in the east on the Euphrates, at the Nushar Carataet, in the pashalic of Marash, whence it stretches west, nearly parallel to the coast of the Mediterranean, for above 500 miles, terminating to the north of the Gulf of Adalia. In the east it takes the name of Jebel Kurun, or sometimes Anti-Taurus Mountains, in the west that of Dagh-e Balabar. It sends off several branches, of which the most remarkable are Alma-Dagh, which proceed south into Syria, and becomes linked with the chain of Lebanon; and the Anti-Taurus, which proceeds north-east, sending out ramifications which become linked with Ararat, Elburz and Caucasus. Many of the Eastern peaks are above 10,000 feet.

TAURUS, the Bull, in astronomy, a name given the second of the zodiacal constellations. It contains the star of the first magnitude Aldebaran (in the eye), the group of the Pleiades (in the neck), and the Hyades (in the face).

TAUSEN, Hans, Danish reformat; b. Birkenel, on Fanen Island, 1494; d. Ribe, 11 Nov. 1561. He studied at Wittenberg and was preacher, from 1525, at Viborg, then, from 1529, at Copenhagen. He edited, with collaborators, in 1533, The 4th Copenhagen Artiz. The 13th edition of 1535 has published a work called a book of homilies. He was appointed reformed master of the university (1537) and (1542) bishop of Ribe. Instead of Latin he used his native language in his sermons and books. A selection of his works was brought out by Rödamin (Copenhagen 1870). Consult Rödamin, 'Skiaographia Lutheri Danici M. Johannes' (1757); Schmitt, L. 'Johannis Tausen, oder der dänische Luther' (Köln 1894).

TAUSIG, Karl, German pianist: b. Warsaw, 4 Nov. 1841; d. Leipzig, 17 July 1871. First he was under his father’s tuition, then studied under Schubert, in Vienna. He made art tours, then lived in Dresden and later (1861-62) in Vienna. From 1866 he was royal court pianist at Berlin and led, till 1870, an academy of pianoforte playing. As a virtuoso he was equally interpreter of classic as of modern piéce-music, but as composer he produced few works. Noteworthy of his productions is his edition of Clements’s 'Gradus ad Parnassum.' His piano score of Wagner’s 'Meistersinger' became very popular. His 'Technischen Studien' was published by H. Ehrlich. Consult Weitzmann, 'Der letzte der Virtuosen' (Berlin 1866).

TAUSSIG, tow'sieg, Edward David, American naval officer: b. Saint Louis, Mo., 20 Nov. 1847. On graduating from the United States Naval Academy in 1870, he was appointed ensign, master and lieutenant, being made lieutenant-commander 19 June 1892. He has served on the European, and Pacific stations and in the coast survey. He took possession of Wake Island for the United States and was placed in charge of Guam 1 Feb. 1899. He was on duty in the Philippines and during the summer of 1900 in North China. He has commanded the Bennington and the Yorktown.

TAUSSIG, Frank William, American political economist: b. Saint Louis, Mo., 26 Dec. 1859. He was graduated at Yale 1887, and has been full professor of political economy there since 1892. He has written 'Tariff History of the United States' (1st ed. 1888; 6th ed. 1914); 'Silver Situation in the United States' (1892) ('Wages and Capital' (1900); 'Principles of Economics' (1911); 'Some Aspects of the Tariff Question' (1915); 'Inventors and Moneymakers' (1915), and has been editor-in-chief of The Quarterly Journal of Economics.

TAUTOG, a marine fish (Tautoga omilus) of the Atlantic Coast of the United States, related to the cunners and wrasses of the family Labridae, and locally known as blackfish or oysterfish. It is from two to three feet in length, when large, blackish in color, the young with about three pairs of obscure dark bars; chin white; eye greenish. It abounds about weedy rocks, oyster reefs, etc., near shore, feeding on mollusks, barnacles, etc., and is easily caught. It is one of the best table-fishes of the American coast. The annual catch off the New England coast is about 750 tons.

TAVERN, a name common especially in the rural districts of Great Britain and the United States for a village inn or hotel. Occasionally some city hotel has borne the name.

TAVERNIER, JEAN-BAPTISTE, French valet de chambre: b. Paris, about 1605; d. Copenhagen, 1689. Before his 21st year he had visited a considerable portion of Europe. He subsequently traveled through Turkey, Persia and other Eastern countries, six times by different routes, trading as a dis-
rechant, and studying manners and cus-
f his journeys he gave an account, assis-
ting him in his literary work. In-
ing realized a large fortune and ob-
potent of nobility, he retired to the
Aubonne, in the Genevese territories,
view of passing there the remainder of
But altering his determination, he was
’t to start over a literary work. In
4), through several editions
iginal French.

OY, tā-voi’, Burma, (1) a town in
im, on the river of the same name,
the district, 35 miles from its mouth,
southeast of Rangoon. It is situated
River, about 30 miles from the bar-
ered by Tavoy Point, a conspicuous
the Burma coast. It lies in a low
which, during the rainy season, be-
swamp. It is laid out in straight
nd the houses are mostly built of tim-
the site of Tenasserim.
. It is about 18 miles long and two
id its southern part is surrounded by
shoals and small islands, which make
dangerous. On the eastern side
a good and well-sheltered harbor,
s received the name of Port Owen.

AS (tā-was) CITY, Mich., village,
at of Iosco County, on Tawas Bay
Lake Huron), at the mouth of the
iver, and on the Detroit and Mackinac
about 66 miles north of Bay City.
good harbor and steamer connec-
y of the lake ports. It is in an agric-
ulumbering region, and nearby are
it deposits. Its industries are con-
attly with the manufacturing of lum-
the shipment of salt, lumber and farm
There is one bank. Pop. about

I TAWI, tā-wē tā-wē’, Philippines,
oup of islands of the Sulu Archipelago,
the extreme southwestern part of the
es, consisting of 88 islands; area, 462
miles. Some of the islands, though
are unnamed; the others are divided
sub-groups or clusters; (a) the Cina-
Kinapusan cluster; (b) the Tawi Tawi
and (c) the Laparan cluster. The area
is mountainous, but of moderate
he valleys and plains are fertile and
with tropical vegetation. Rice, corn,
d coffee are cultivated, but only for
use; the forest wealth is considerable,
ct of commercial value on account of
transportation. The chief in-
ishing, pearl fishing and gathering
of-pearl, etc. The islands are sparsely
populated and, as many are very inaccessible,
have been for many years the hiding places of
pirates; the few settlements were originally estab-
lished by the Spaniards. (2) The largest and
name island of the Tawi Tawi group; length
from northeast to southwest, 35 miles; greatest
width, 15 miles; area, 187 square miles. It is
mountainous, and of volcanic formation; there
are three groups of two peaks each, one at the
southern end, one at the northern end and the
third in the east central part; greatest elevation,
1,941 feet. The soil is generally fertile, and the
island well wooded; the chief industry, as in
the rest of the group, is fishing. Taws chief
settlement is Tatun, on the northwest coast,
on a small bay.

TAWNÉY, James A., congressman:
near Gettysburg, Pa., 3 Jan. 1855; d. Excelsior
Springs, Mo., 12 June 1919. He was educated
at the common schools and learned the black-
msmith’s and machinist’s trade. He went to
Winona, Minn., in 1877 and worked there as a
machinist for four years. He was admitted to
the bar there in 1862 and practised law until
1889, when he was elected to the State senate
of Minnesota. In 1893 he was elected to the
53d Congress and served continuously until
1911, when he was defeated by the Progressive
party. Mr. Tawney was appointed by ex-
President Taft to the International Joint Com-
mission created by treaty with Great Britain
for the settlement of disputes between the
United States and Canada, and was chairman of
the United States section of the commission un-
til his death. Mr. Tawney had great political
power in Minnesota, and took an active part
in the anti-trust legislation, in 1907 he was
vice-chairman of the Republican Congressional
Campaign Committee. He was known in the
Republican party as an insurgent and continually
surprised the Republican machine while in Con-
gress by bolting. He was an orator of great
power. He was chairman of the House Ap-
propriations Committee until 1910, and long
championed a Federal budget system. Tawney
was defeated for re-election in 1910, when he
opposed reform of the power of the speaker
of the House. In 1910 he opposed the efforts
of the Republicans to increase appropriations
for the army and navy.

TAX ASSESSORS. See TAXATION.

TAX-DEED, an instrument or conveyance
whereby the proper officer of the law undertakes
to convey the title of the rightful owner to the
purchaser at a tax sale or a sale of the land for
non-payment of taxes. This deed, according to
the principles of the common law, is simply
a link in the chain of the purchaser’s title. It
does not of itself transfer the title of the owner,
as in grants from the government of deeds
or as do conveyances between individuals. The
deed is not the title itself, or even evidence of
it, its recitals not being binding. No presum-
tion arises upon the mere production of the
deed that the facts upon which it is based
really existed, but when it is shown that the
officers of the law have performed every duty
imposed upon them the deed becomes conclusive
evidence of the title in the purchaser.

TAXALES. See PALEBOTANY.

TAXATION. What Is a Tax? — A
distinction must be made between a tax and the
exercise of the power of taxation. Property may be taken from individuals by the government under the title of various sovereignty as powers, such as the power of eminent domain, the penal power, the police power and the taxing power. Where the purpose of the compulsory payment is neither to exercise the right of eminent domain nor for punishment nor primarily for purposes of regulation, we have to deal with the power of taxation. The power of taxation may be exercised, however, in several ways. The government may perform a service for the individual from which a specific benefit is received and where the cost of the service is presumed to be covered by the payment. Such payments are called fees or tolls. Or, again, the government may, with or without the consent of the individual, make an improvement which increases the value of his real estate and may impose what is technically called a special assessment or a betterment charge. Finally, the government may impose a payment on the individual where the special benefit, if any, is merely incidental. Such a payment is called a tax. The narrower sense are to be distinguished, therefore, not only from fines and penalties as well as from prices (charges made by the government when it carries on a commercial or industrial undertaking) but from fees or tolls and from special assessments, both of which are equally manifestations of the taxing power, but which are distinguished from taxes in the narrower sense in that the special benefit accruing to the individual is both positive and measurable.

A tax may, therefore, be defined as a compulsory contribution from the person to the government to defray the expenses incurred in the common interest of all, without reference to special benefits conferred. Each word in this definition is significant. A tax is a contribution, whether in money or in kind; it is compulsory (to distinguish it from a gift); it is paid by a person—either a natural person, like an individual, or an artificial person, like a corporation; it is paid to the government in any of its forms, whether local, State, Federal or international; the expense must be incurred in the common interest of all, or, in legal parlance, it must be for a public purpose; otherwise it is confiscation, not taxation. Finally, it must be paid without reference to special benefits conferred. It is levied for the common benefit, not for any special benefit.

The Reason of Taxation.—By the reason of taxation is meant the ground or the philosophical justification of taxation. The older theory may be called the exchange or the contract or the reciprocity theory. It was connected with the 18th-century contract theory of the state. This theory holds that taxes are a mere exchange between the individual and the government. The point is that the individual gives the government something in return. This theory has been completely superseded by the more modern political philosophy. The modern theory may be called the cost or the race or the theory of taxation. It does indeed deny the obligation of the government to do something for the community in return for the payment exacted from the community. In this sense, indeed, reciprocity; but it is an exchange the community cost only for the government something which represents the community cost only for the state. He is born into the state, transfers his political allegiance, without any reservations. In this sense the state is as much a part of the individual as the individual involuntary assumes obligations to his family, so he assumes obligations to the state in which he is. It is, therefore, as much his duty to support the state as it is to himself. The obligation to pay tax, therefore, be declared in modern in a natural obligation and the state is justified in converting this moral obligation to a legal obligation.

The Function of Taxation.—The function of taxation, therefore, is to revenue. This may be declared to be the function of taxation. As a matter of fact, taxation has always been for other purposes which may be declared secondary or incidental in character. A function may be declared the social, rather the fiscal, function of taxation. Taxation has at various times employed an imperative power to destroy or to foster economic activity. At the present time, in the States, for instance, we have a tax which utterly destroys the pro phosphorus matches. We have, or taxes designed to foster or prohibit forms of domestic industry. In that there have been two extreme schools of the one represented in the United Statesmen like Calhoun or publicists like A. Wells, who have contended that the primary function of taxation is fiscal and, for instance, means con other extreme represented by such and by professorial socialists like A. T., have maintained that the primary function of taxation is to effect changes. A logical corollary of this position that no payment can be required that it seeks to effect social changes. In modern and more moderate positions, while the primary function of tax be the fiscal function, there is a refusal to bring about, incidentally, taxation, desirable social reforms that are as such the community. The Nature of Taxation.—Is it good or a bad thing? Is it a
TAXATION

Here again we have two schools of thought. The older writers, of whom Jean Say is a good example, adopted the consumption theory of public finance, that governmental functions ought to be supported by a minimum and that the exercise of governmental functions is burdensome upon the community. The tax is that the government spends for the public welfare is based upon the productivity of the community. The nice is that all government expenditure should be reduced to a minimum and that, as far as is possible, the producers should be the only or the chief productive people. Some taxation may be legal, political or economic. The legal limitations upon taxation are creatures of positive law. The government, in the United States for instance, is enjoined from levying a tax on exports. The State governments are prohibited from levying any taxes which will interfere with interstate commerce. Both State and local governments are frequently enjoined from levying more than a maximum rate of taxation. The political limits of taxation may be illustrated by the provision of American law, that all taxes must be for a public purpose. The exact formula of what constitutes public purpose is something which has given great trouble to our judges and legislators. The limits of taxation are seen when we reflect that the ultimate source of all taxes is the social income and that the demands of government in the form of taxation may trench unduly upon this income. We have seen how many forms of taxation have been used with the expectation of being of a tax. If the expenditure is a waste, it is a proper use of the American colonists, there were three fundamentally different systems of taxation, corresponding to the system of small farms and petty industry in the New England colonies, to the dominance of business interests in the middle colonies and to the plantation system in the Southern colonies. The fiscal system of the feudal ages rested largely upon land. The success of the tax on personal property was and is very different in the towns from what it was in the country. The growth of modern forms of business has brought with it an entirely new system of taxation. The main influence is attributable to the introduction of the modern system of progressive taxation. In the third place, we note the development of the idea of limits to be expected, but in relation to the source from which taxes are derived. It is a question not what do you do with the tax, but from what source do you get the tax? In other words, no matter how ideal in other respects a tax is, it may impose too heavy a burden upon the community. The limits of taxation may be legal, political or economic. The legal limitations upon taxation are creatures of positive law. The government, in the United States for instance, is enjoined from levying a tax on exports. The State governments are prohibited from levying any taxes which will interfere with interstate commerce. Both State and local governments are frequently enjoined from levying more than a maximum rate of taxation. The political limits of taxation may be illustrated by the provision of American law, that all taxes must be for a public purpose. The exact formula of what constitutes public purpose is something which has given great trouble to our judges and legislators. 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f. faculty or ability to pay. More and more the system of taxation has been molded by the desire to fix the burden to the capacity of the contributors and the tests that have been progressively devised to measure that capacity, as will be seen below, undergone a continual modification. In the fourth place, side by side with the adoption of individual faculty we note the substitution of the social for the individual treatment of the element, that is, a system modified by a study of the social consequences and economic effects of the tax system upon the various economic classes in the community as a whole.

Influence and Effects of Taxation. — The effects of production. Here again two theories stand opposed to each other. A former school contended that taxes stimulate production. It had been claimed by some that a new tax evokes a new ability to bear the tax and that in this sense an increase in the seeming burden may really augment the industry of the people. It has been argued that if industry in general is the result of coping with the natural disadvantages, such as the inclemencies or difficulties of nature, why should not the same result be brought about in other ways, e.g., by taxation? Attention is directed to the period of the Napoleonic wars where the increase of British taxes seemed to result in greater power to bear the taxes. On the other hand, we find the contention that all taxes are injurious, or, as in the case of the Single Taxers, that all taxes excepting the land value tax exercise a deleterious influence because they are taxes on labor and industry and, therefore, check or retrograde the industry.

The truth again lies in the midway. It is undoubtedly a fact that some taxes seem to increase industry. But if regarded more attentively it will be seen that the tax is the occasion, rather than the cause, of the redoubled activity and in that almost all cases the lure of profit rather than the fear of loss is the real stimulus to productivity and invention. It is undoubtedly far more frequent that industry is injuriously affected, rather than benefited, by the tax. But it is true that every tax excites an injurious result. If certain principles of equality are observed, it is possible for a tax to be innocuous so far as the producer is concerned, and, at the same time, to have the consumer benefit more from the results of the government outlay than he suffers from the tax. There is no broad generalization to be framed in this respect. According to the character of the particular impost, taxation may be said to have educational, destructive or regenerative effects. There are two points of more general influence. One is connected with the inequality of taxation. If an exclusive or unequal tax is imposed upon some permanent source of revenue, the tax or the excess of the tax over the normal rate will be amortized or capitalized into the diminution of the selling value. If 1 per cent is assessed upon securities, for instance, which bear 5 per cent interest and have been selling at par, the new purchaser will pay only about 84 per cent. This is known as the capitalization of taxation. The same tendency of things to seek their level is found in the imposition of a new tax in general. A French writer, Duvergier, had laid down the principle that every new tax is a bad tax and every old tax is a good tax. What he meant was that the disturbance of industry by the imposition of a new tax often takes some time to allow this of course must not be misinterpreted. The belief that a tax which is inequitable, can ever become good through the lapse of time is marked. The chief reason, for it there is no large class of real estate. Parishes as compared with New York is a case in point of a system modified by a study of the social consequences and economic effects of the tax system upon the various economic classes in the community as a whole. The effect of taxation on exchange is the so-called price doctrine. In its original form it held that every time a tax was changed hands the tax grew in proportion, for as the profits of the are added to the price, the tax is added each case successively on the new price, increasing the profits. This alleged principle, ever, is open to the objection that according to modern economic theory, profits are not of price, but the result of price and the price is in turn set at a certain cost. The element of truth contained in this principle is due to the fact that interest part of cost and that to the extent that on the successive prices is of any importance the theoretical tax tends to be cumulative. The impact of taxation on distribution is indisputable. Taxes are designed to have such an effect as to high inheritance taxes, graduated income, but many taxes also have unexpected effects. A general and well-recognized maxim is "leave them as you find them" doctrine that the ideal tax ought to leave every individual in the same relative position as the imposition of the tax. This is not accepted as an ideal.

The influence of taxes on consumption is less important than in former times. In the Middle Ages a sumptuary tax was common. It was, however, not consumption, but necessary consumption was frequently sought to be hit by means with which taxes of certain kinds made to check consumption are so pronounced that it is primarily in periods of war that recourse is taken to this medium.

The political effects of taxation are important than the economic. The government itself has been influenced by the effects of taxation.

Incidence of Taxation. — By the term a tax is meant its final resting place, or its original assessment, the shifting of its transfer, and the incidence of a tax to its final resting place. Shifting is incidence is the result the tax is not always the one who pays in the first instance. This has led some to lay down the so-called equal-diffusion of taxation, the theory, namely, that economic is like any organism and that the tax will influence the community as a whole, it will at once be diffused throughout. The tax, therefore, no matter where it will be shifted to the community at large, the theory suffers from undue generalization. It is true that certain taxes give rise to such in economic relations that they may
o be ultimately spread over the com-
There are, on the other hand, many
which do not lead to this phenomena and
e which are not shifted at all. A dis-
ust furthermore be observed between-
tion and shifting. If a tax is shifted,
be capitalized; if it cannot be shifted.
There are certain conditions
pose to the shifting of taxation.
general a tax is the less likely is it
ited because the smaller the tax the
to which the individual can betake
Where commodities are produced un-
ing conditions, much depends upon the
tax is imposed upon the marginal
trimal producer. Where a tax
upon land which produced a com-
th a local market, the tendency is for
be shifted to the consumer. If the
posed on the North Dakota farmer
seat is sold in Liverpool, the shifting
depends upon the relative cost of
x and the existence or absence of equal taxes
ountries. Where a tax is imposed not
ibilities or property in particular, but
its or income in general, the tendency
much less pronounced.
With taxes
tricted to a relation to the faculty or the kind of income, the situation is
sifting of the tax is of importance not
between producer and consumer, but
between borrower and lender. In taxes
mortgages or upon funds bor-
e incidence of the tax depends to a
ent on whether the tax is general or
If the tax is levied as a part of a
income tax, it will not be shifted; if, it
is an exclusive or unequal tax,
law or in actual operation, the tax
arily be shifted from the borrower
der. A complete study of the shift-
xation would involve a treatise on the
and distribution of wealth.
Ciples of Taxation.—There are four
ets of principles of taxation, fiscal,
itive, economic and ethical. The
iples are those of adequacy and
of a tax; the efficiency of a branch
that is needed or expected, it
prounced successful. Again, un-
x is so elastic as to respond to the
ances in economic conditions, it is
be depreciated. The
administration of taxation are those of certainty of
ice and of economy. Unless a tax
tain in its provisions, it is a bad law.
agreement, for instance, be-
certainty of a land tax and the un-
of a comprehensive or of a compi-
ent tax. The principle of conven-
taxation includes the question of how
is to be paid, when it is to be paid,
and under what conditions: or, otherwise, it is to be
the economy of taxation implies that a
ld take out of the pocket of the peo-
tle as possible above what it brings
government, or, in other words, that of
c economy. The two co-
cept of taxation may be declared
nucity and efficiency. The
or harmlessness of a tax is a most desirable
tribute. All taxes, indeed, represent a burden
but, as has been pointed out above, certain
taxes have a far more destructive effect than
others. Other things being equal, the legislator
must choose the most innocuous tax. By the
efficiency of taxation is meant the capacity of a
tax to accomplish the desired result. Many
a tax is admirable in other respects, but can
be made to work in practice only with diffi-
culty. The present property tax, for instance,
in the United States is to-day no longer an
efficient tax. The ethical principles of taxation
are those of uniformity and universality. As
these are the most important, they will be dis-
cussed separately.

Uniformity or Equality of Taxation.—
By equality is of course not meant absolute
numerical equality, but relatively proportional
equality. Uniformity, in other words, means
relative uniformity. The question then arises
as to the relation involved. To what should
be to be uniform? In former times the answer was that the real
basis of taxation should be either the cost of
service to the government or the value of the
service to the individual. The more modern
theory maintains that taxes should be in some
relation to the faculty or ability of the indi-
vidual to pay. Much time has been spent upon
the problem of what constituted the real
elements of faculty. For a long time faculty was
stated in terms of capacity. By equality of
taxation there is meant an equality in the sacri-
ce imposed upon the individual. In more
recent times, however, emphasis has been put
upon another aspect of the problem. Sacrifice
has to deal with the phenomenon of parting
with one's wealth. It involves the question of
what is left for immediate consumption after
the tax has been paid. But economic life deals
not only with consumption, but with production.
When we come to consider the production of
wealth rather than the consumption of wealth
we are confronted by the facts of opportunity
or privilege in the amassing of wealth. A
man's ability to pay a tax, therefore, must be
considered not only from the point of view of
consumption but from that of production. In
other words, the two elements of tax liability are
privilege and sacrifice: the easier it is for a
man to make his money, the more ability he
has to pay taxes; the harder it is for a man
to be deprived of his money, the less ability
he has to pay taxes.

The Norm of Taxation.—By the norm of
 taxation is meant the test of faculty. There
have been no less than five such tests disclosed
in the history of taxation: (1) The first test of
faculty was poll. Everyone was supposed
to have an equal ability to pay. In a primitive
form of society the poll tax was legitimate.
It has virtually disappeared today except in
a few democratic communities like the United
States, where it still lingers as a survival of a
former and more primitive equality. (2) Ex-
penditure. The advantage of expenditure
is that is no one can escape because every-
one spends something. The disadvantage of
expenditure as a test of faculty is that
some people must spend all they make, while
others can save most of what they make. Ex-
penditure thus becomes an increasingly unsatis-
TAXATION

factory test of faculty; (3) Property. In a comparatively early form of society wealth in terms of property is an excellent test of faculty. The general property tax is accordingly found everywhere at a certain stage of development. The more complicated and the more differentiated the society, the more apparent, however, are the shortcomings of this test. The chief modern defects of property as a test of equality in taxation are the following: (a) While it is generally true that capital is nothing but capitalized income, there is in modern times frequently a discrepancy between the property and the yield or produce of the property. This may be due to speculation, to chance or to other accidents of economic life; (b) In modern times more and more wealth is derived from personal earnings rather than from property. The property tax would hit the owner of a $10,000 farm but leave untaxed the recipient of a $100,000 professional income; (c) There is a great difference between the legal and the economic value of property. Economically a man's wealth measured in terms of capital is his surplus over debts. Legally, property is independent of the debts. I may own a $10,000 farm even though I have borrowed $5,000 on it. A property tax frequently fails to make allowance for debts; (d) The concept of property fails to distinguish between consumption and production property. The property tax makes no distinction between the lawyer's library which contributes to his income and a philosopher's library which may be a source of expense. 4. Product. The difficulties with the concept of property as a test of faculty led to the substitution of yield or produce as the proper test. Almost everywhere at a certain time the general property tax on the individual was, therefore, replaced by a series of taxes on the things themselves, measured by their product. Instead of a general property tax we now find a land tax, a capital tax, a business tax, a wage tax, etc. Produce is in some respects a more satisfactory test of faculty than property: it gets closer to the realities. But in the course of time a weakness disclosed itself in that not enough attention could be paid to the individual conditions of the recipient of the income. The modern world has, therefore, come to large measure to an acceptance of the fifth test of faculty, which is that of income rather than of property or of produce. The tendency is accordingly stronger for the replacement of the older taxes by modern taxes on individual income and business profits.

Graduated Taxation.—A further refinement, however, of the idea of faculty is seen in the growth of graduated or progressive taxation. Proportional taxation is giving way to graduated or progressive taxation because of the realization of the fact that graduation, although a technical breach of uniformity, really involves a higher uniformity. Progressive taxation is now almost everywhere recognized even in American jurisprudence, as involving no inequality of taxation. A graduated tax is a tax the rate of which increases with every unit of the base. The entering wedge of the theory of progressive taxation is found in the minimum subsistence doctrine, the doctrine, namely, that a certain amount of income should be exempt from taxation because that is indispensable to existence. This was soon pushed further in so far as placed upon the element of sacrifice; the sacrifice involved in taking by taxation a man with a $1,000 income was less than the sacrifice involved in taking $10,000 from the man with a $100,000 income. In one case the tax trenches on necessities and in the other it affects superfluities. After some time, however, conception of sacrifice was re-enforced by privilege. The difficulty of making $1,000 of a man's fortune is far less that of making subsequent accretions. Modern democracies are accordingly fixing a graduated or progressive tax.

Differentiated Taxation.—The principle in taxation results not only in graduated taxation but in what is called differentiated taxation. Graduated taxation implies a change in the rate according to the amount of income or property. Economically, a man's wealth measured in terms of capital is his surplus over debts. Legally, property is independent of the debts. I may own a $10,000 farm even though I have borrowed $5,000 on it. A property tax frequently fails to make allowance for debts; (d) The concept of property fails to distinguish between consumption and production property. The property tax makes no distinction between the lawyer's library which contributes to his income and a philosopher's library which may be a source of expense. 4. Product. The difficulties with the concept of property as a test of faculty led to the substitution of yield or produce as the proper test. Almost everywhere at a certain time the general property tax on the individual was, therefore, replaced by a series of taxes on the things themselves, measured by their product. Instead of a general property tax we now find a land tax, a capital tax, a business tax, a wage tax, etc. Produce is in some respects a more satisfactory test of faculty than property: it gets closer to the realities. But in the course of time a weakness disclosed itself in that not enough attention could be paid to the individual conditions of the recipient of the income. The modern world has, therefore, come to large measure to an acceptance of the fifth test of faculty, which is that of income rather than of property or of produce. The tendency is accordingly stronger for the replacement of the older taxes by modern taxes on individual income and business profits.

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Ordinarily, to tax property is virtually to tax the income of the property. To come again will then be double taxation. It serves no purpose to distinguish between earned or unearned incomes or to separate taxation, where in other cases it is to tax property incomes; other incomes, that form of double taxation is legitimate. Another example of taxation is to tax the corporation and its shareholder or to tax both the property and the income, because ordinary conditions of American life are expensive and the lender will be shifted to the borrower who will pay the tax on his own property but on that of others. Double taxation by competing jurisdictions is found when the same individual owns property is simultaneously taxed by jurisdictions. The tax is on the same property and the same property. The avoidance of such double taxation is possible. The one international agreement or the exerts may be taxed on the same property in all states. The avoidance of such double taxation is possible either, on the other hand, the separate property taxes gradually developed into a general property tax, which became the chief source of state and local revenue. The tax was being added to the local tax in the public before the annual rate of taxation was determined. With the progress of society and especially with the growth of intangible personality, personal property slowly slipped out of the assessment lists, so that the general property tax again became in fact, if not in law, a real property tax in great measure. This led, in the third quarter of the century, to an attempt to tax personal property through special taxes on certain corporations. Toward the close of the century the corporation taxes were supplemented by inheritance taxes. In several States liquor license taxes were added. Only in the Southern States do we also find a system of business or occupation or so-called privilege tax at a survival of the Slavery system, where the plantation owners attempted to roll off the taxes on urban occupation.

The addition of corporation and inheritance taxes did not entirely solve the problem of the personal property tax. A two-tiered system of tax accordingly developed in the 20th century. On the one hand we find the tendency toward the classification of personal property tax, with lower rates for certain classes of personality like money, securities, mortgages, etc. On the other hand came the movement for the replacement of the personal property tax by the income tax. Wisconsin took the lead in 1911, Massachusetts followed in part in 1915 and New York imposed a corporate income tax in 1916 and a personal income tax in 1919. Several other States have followed their example. The trend is now strongly toward a system whereby real estate will be taxed for local purposes and the State revenues be derived from an income tax, an inheritance tax and a corporation tax, part of the proceeds of which will be distributed to the local divisions.

The Federal tax system has also gone through several stages. At the beginning the Federal revenues were derived from import duties as well as from a variety of internal excises — including for a short time a direct tax on land and on slaves. The advent to power of the Anti-Federalists in 1802 caused an abandonment of the so-called internal reve-
TAXIDERMY

The art of stuffing and mounting the skins of animals, or their heads, so as to appear natural and lifelike. It is no longer a question of filling out a skin, but rather of making a statue of a creature long since dead, which will exactly fit the skin of that particular creature, stand erect and pose as the counterpart of life. "Taxidermy, the handmaid of zoology," said Dr. J. A. Allen, "has already become one of the fine arts, requiring the skill and judgment of both the sculptor and the painter, and capable of yielding results comparable with the masterpieces of either."

It is, furthermore, one of the newest of the arts and there is serious need of a well-established school of taxidermy in connection with some one of our great museums. Prior to 1880, one American museum (the National) maintained a corps of taxidermists, but not a single one. The majority of the mounted birds and mammals which found their way into other American museums were mounted at Ward's Natural Science Establishment, by men from France and Germany. Methods were crude and if anything were far below the standards attained twenty-five years later. Much of the work produced to 1880 has since been either dismantled or destroyed.

In March 1880, at Ward's establishment in Rochester, N.Y., Messrs. Hornaday, We Lucas, Martens, Bailly, Critchley and F. E. organized the National Society of American Taxidermists and seriously began the task of developing taxidermy up to the level of fine arts. All jealousy and exclusiveness were swept aside and the three competitive sections that were held in Rochester, Boston and New York finally opened the eyes of men and of the general public also to the possibilities of scholarly taxidermy, when the early impetus then gained has already carried American taxidermy beyond the original hopes of the founders of the society and the museums.

In Europe, America is now being filled with monographs that in large measure are not of real educational value but are also agreeable to the eye. No modern American museum now complete without a well-equipped department of taxidermy, in charge of a chief taxidermist on a salary, which in 1880 would have been considered unattainable.

In a modern, high-class taxidermist, the requisite is not a knowledge of methods mounting, but the thorough education of the eye in animal forms and expressions, must be secured by courses in drawing, painting and carving. The skeleton, external muscles of animals must be studied, the latter from life. Besides the ingenuity of numberless sketches from life, but of live-animal photographs should be considered. Care in arranging and arranging for reference. Casts of and special parts of dead animals are of importance and should be diligently collected. At all times must the natural history of the vertebrates be studied and kept in mind. This preparatory work has been accomplished, the aspirant for taxidermic honors must have admission to the laboratory of some master and work with him to acquire knowledge of methods.

A comparison of American with European taxidermy is of but passing interest, chiefly owing to the reason that an international exhibition it is impossible to draw parallels from the study of one's own work. From three inspection European zoological museums, 1896 and 1902, it is the opinion of the writer that the best of our museum taxidermy is considerably in advance of the best to be found in Europe. The groups of mammals, especially small, that now are so intensely interesting with the zoological gardens and parks of New York, Pittsburg, Chicago, Milwaukee and the University of Kansas, have no counterpart in Europe. The British Museum of Natural History, South Kensington, contains a series of groups of birds, mounted with
es. In the museum of the Amsterdam Artis Magistra, there are a number of groups of birds. In the museums American cities mentioned above the fly groups representing the bison, caribou, musk-ox, deer, antelope, zebra and other animals, all provided fully-studied natural accessories, condoning monuments to the skill of museum officers who have actively the development of American taxi-Pro. Spencer F. Baird and Dr. G. Soodey stand first. As early as 1880 located the attainment of perfection in regardless of time or cost. It was by sent and cooperation that the National set the pace in the development of setups of mammals, which really began with the group of American bison. Section honorable mention is due Prof. A. Ward, founder of Ward's Natural Establishment, for the far-reaching inserted by him for the improvement of methods generally and the company which is now appended to the Society of Taxidermists.

The improvements noted in museum, equal advances have been made in of what is known as custom taxidermy. Iber of trophy heads of large mammals now mounted annually in the United States are less than about 1,800. About 40 are heads of deer and the remainder moose, mountain-sheep, caribou, elk, mountain-goat, buffalo, musk-ox and out in the order named. Twenty-five to a finely-mounted head was a rarity, any, outside of the workshops of amably-mounted head is seldom seen. Standards of excellence have risen very. The demands of patrons are more in and good work is better compensated eto fore.

The world's mammals, birds and other decreases, museums multiply, and the provision fine collections becomes more and more urgent. New York now offers a 11 for a limited number of young men artistic instincts who can bring to it education and training and unlimited for hard work.

Important American works on taxonomy should be enumerated: Hornaday, "Hornaday, Taxon: and Zoological Collecting" (1892); "Methods in the Art of Taxidermy" Rowley, "Art of Taxidermy" (1900); K., "Guide to Taxidermy" (Worcester.

W. T. HORNDAY,
Director New York Zoological Park.

TAXING DISTRICT. See DISTRICT.

XYONYM IN PLANTS, from the Greek words παίζει ταξινομείν, meaning and nomen, nomos, law. Called taxonomy. It is the study of class, especially from a biological aspect, and of the morphology of plants. Life. Ray divided the vegetable kingdom into two classes: the Flowering and the Flowering everything on one single character, a little over a century later, formed the plant world into two groups: Cormophya and Thallophyta, but the division was very imperfect and overlapping. Later we found two groupings by Linnaeus under the names: Phanerogamia and Cryptogamia, the former having flowers with stamens and pistils, the latter flowerless, seedless and propagated by spores. But the designation Cryptogamia, still retained by a few, their generative method being no longer cryptic (occult) or hidden from our present advanced knowledge. Thallophyta, still remaining in general use, no longer describes the class formerly considered by the expression. Thus with ever-increasing knowledge of the life-workings of the plant realm bringing new facts we have had to change repeatedly the system in taxonomy to bring the additional facts into close relation. And so the system of Ray gave way to the Endlicher, the latter to the greatly improved system of Linnaeus (1735) with its 24 classes divided according to the number and disposition of the stamens, with variant orders according to the number of styles or stigmas, etc. This method of systematization, proving its deficiencies more with a deeper investigation of plant nature, had to give way (1813) to the Candolle system, soon to be displaced by the Sachs method of classification with its seven divisions, Protophyta, Zygo phyta, Oophyta, Caryophyta, Bryophyta, Pteridophyta, Phanerogamia. The Sachs system is much in use to this day, but the most recent classification of botanists, based on the great advances brought about by microscopic and other researches into the plant structure, which keep disclosing weaknesses of the former system, are the following four main classifying divisions: (1) Thallophyta; (2) Bryophyta; (3) Pteridophyta; (4) Spermatophyta. The first three belong to the Cryptograms, the latter to the Phanerogams. It is an improvement generally considered better suited to the enlarged range of the botanist's vision; but already criticism is creeping in and taxonomy in plants may be subjected soon authoritatively to a further revision.

(1) Thallophyta. This division includes all of the four primary classes, the uni-cellular organic growth, having root, stem and leaf undefined. Under this head come the algae, fungi, bacteria and lichens. (See BOTANY).

(2) Bryophyta. These include the mosses and liverworts (hepatica), with distinct sexual organs in some, but in this division (as above stated) is the liverwort and other plants of the thallus type. (See BRYOPHYLLUM). (3) Pteridophyta. These are often termed vascular cryptograms and include chiefly the ferns with their propagation by spores. Their stem, leaf and root are clearly defined. (See PHANEROGYTA). (4) Spermatophyta or Phanerogams. These are being lately divided into angiosperms and gymnosperms and the angiosperms are sub-divided into dicotyledons and monocotyledons. The Spermatophyta are the highest division of plants including those having true flowers and seeds. They are for the most part land plants, while many of the former divisions are aquatic. Their female cell (oospore) is fertilized in propagation and, protected by the ovule, becomes a seed, the seed formation being the characteristic of this group (termed also seed-
TAY—TAYLOR

plants). (Gymnosperms of this division have
unsewelled flowers and naked ovules, with direct
pollen fertilization, etc. (See GYMNOSPERM.).
Angiosperms have a closed seed vessel (carpel)
and other distinguishing characteristics. See
PLANTS, CLASSIFICATION OF.

TAY, tā (1) A river in Scotland, in the county of Perth, formed by two head-streams, the one rising from the northeast end of Loch
Tay and the other from Loch Lyon, a small
lake on the borders of Argyllshire. The two
streams unite about two miles northeast of
Loch Tay, whence the river flows past Aber-
feldy, Dunkeld and Perth, at which last town
it widens out into an estuary from one to three
miles in breadth, becoming the northern bound-
ary of the county of Fife. The whole length is
120 miles and the area of basin 2,250 square
miles. Vessels of 500 tons ascend to New-
burgh and those drawing nine feet to Perth.
Its principal tributaries are the Tummel and
Isla on the left and the Braan, Almond and
Earn on the right. During the upper part of
its course Tay flows through a wild and highly
romantic country and subsequently, after entering Strathmore, through the richest and finest valley in Scot-
land. In the summer of 1878 a railway bridge
spanning the estuary of the Tay at Dundee was
opened for traffic, but on 28 Dec. 1879 13 spans,
crossing the navigable part of the river, were
blown down in a violent storm, a passenger
train, which then happened to be crossing, be-
ing precipitated at the same time into the river.
A second bridge, over two miles long, with 85
spans and carrying two lines of rail, was
opened in 1887. (2) A loch in the county of
Perth, a picturesque sheet of water 15 miles
long and about one mile broad; receiving at its
southwest end (near Killin) the Lochay and
the Dochart and discharging at its northeast
end at Kenmore by the Tay. It is 100 to 600
feet deep and is well supplied with fish.
On its northwest shore rises Ben Lawers.

TAYABAS, tā-yā bahs, Philippines, (1) Puente Extender of Tayabas; on Tayabas River,
five miles inland, 65 miles southwest of Manila.
Under Spanish jurisdiction it was the capital of
the province, and is the largest town. It is
an important road centre and carries on a
large trade. Pop. 15,000. (2) Province, form-
ing the western part of southern Luzon; bound-
ed on the north by the Pacific Ocean, and
Lamón Bay and Ambos Camarines, on the east
by Ambos Camarines and the Visayan
Sea, on the south by the Mindoro Sea, and
on the west by Batanacan and Lomaca; area,
about 5,000 square miles. The outline is very
irregular; its extreme length from Point Piapi
in the northwest to Point Paseanjan in the
southeast is 102 miles; and the distance from
the northeastern boundary to Soudal Point
on the southwestern coast is 57. Its coasts are
indicated by three of the largest bays of the
Philippines, Lamón on the north, Raday on
the east and Tayabas on the south. The province
is generally mountainous, the main central
chain being mountainous and this range extends
out spurs on each side. There are numerous small rivers and streams.
The soil of the valley is fertile; on the lower
levels rice, sugar and coffee are raised and
grain on the higher levels; a special product
is a seed called lumhang from which
may be made; the coastline is crowded in large.
ities. The forests contain a variety of
for building purposes, besides gum and
trees; and large quantities of timber and
products are exported. The mechnical
tries of this province are of considerable
importance; the manufactures include hats,
cases and boxes and native fashions; the
also mills for extracting coconut oil.
number of boat-building yards for the
struction of native boats. Stock-ra
also of some importance. The provi
good communication by water with all
the Philippines, and is traversed by a
highway from Sorosogon to Manila; the
also several other roads and trails.
The Itans of the western part of the provin
Tayabas, those of the eastern part are
Civil government was established in
1901, in accordance with the law of the
pine Commission. Pop. about 150,000.

TAYGETUS, tā-jē tūs, Greece, a
chain range running down the central part
of southern Mores. It is a steep and un
ridge rising in Hagios Elias to a be
7,904 feet. It separated an area of
Messenia and was known in the Middles
as Pentedakylon.

TAYLOR, tā lōr, (James) Bayard, J
can writer: b. Kennett Square, Pa., 1
1825; d. Berlin, Germany, 19 Dec. 1877
had a secondary education at West Chest
Unionville, and in 1842 was appointed to
printer in the former town, but did not
out his apprenticeship. In 1844 he set
Liverpool, and during the next two years
traveled, chiefly on foot, in Great Britain,
Germany, Austria, Italy and France.
described his journeys for several Am
newspapers, his letters being collected an
lished on his return under the title 'A
foot or Europe Seen with Knapsack
Staff' (1846). In 1847 he received an
ment on the staff of the New York 'Times
and two years later went to California
special correspondent of that newspaper
old-fields, his letters being republ
1850 as 'Eldorado, or Adventures in
of Empire.' In 1851 he was again in E
before returning to the United States.
1854 he visited Egypt, Asia Minor, India,
ong, China and Japan. Among the
results of this tour were 'A Journey to
Africa' (1854); 'The Land of the Sa
(1854), and 'A Visit to India, China
Japan' (1855). On these traveling expedi-
he lectured with much success. He had a
time gained some reputation as a
'Nimena and Other Poems' (1844); '
Travel, Ballads, and Other Poems' (1
'Book of Romances, Lyrics and Poems'
(1851), and 'Poems of the Orient' (1
and in 1855 he published a collective
these under the title 'Poems of H. T
Travel.' 'Northern Travel' (1857) con
account of his visit to Greenland.
Land. In 1862-63 he was secretary of
tion and for a time chargé-d'affaires at
Peter-burg, and in 1870 he lectured at
University on German literature. He b
United States Ambassador at Berlin in
addition to works already mentioned may be enumerated: 'At Home d' (1859-62); 'Byways and Europe' translation of Goethe's 'Faust' in 317 (1870); the novels; 'Hann
ton' (1863); 'John Godfrey's For
cy' (1880); 'The Story of Kennett' (1880);
d 'His Friend' (1870); 'The Poet's '1918' and other volumes of verse;
ations of miscellaneous writings ap-
sthumously, 'Studies in German'
'1879,' and 'Essays and Notes' t is by his translation of 'Faust,' the finest attempts of the kind in any
that Taylor is generally known; yet
final poet he stands well up in the
k of Americans. His 'Poems of the
nd his Pennsylvania ballads con-
est work. His verse is finished and
but at times over-rhetorical.
Life and Letters' by his wife and
OR, Bert Leston, American author:
Mass., 13 Nov. 1856. His column
Line O'Type or Two in the Chicago
newspapers and books humorously, attracts
ularity. He has written 'The Well
Vood' (1904); 'The Charlatans'
A Line-O'Verse or Two' (1911);
esmoke Carry' (1912); 'Potley
1913); also two booklets, 'The
' and 'The Book Booster' (1901).
OR, Brook, English mathematician:
18 Aug. 1685; d. 29 Dec. 1731. He
ated at Saint John's College, Cam-
1712 chosen a Fellow of the Royal
1714 appointed its sec-
he maintenance of Taylor's works, in
715, is entitled 'Methodus Incre-
icta Directa et Inversa.' It contains
or theorems of less consequence, a
one, which is hence called 'Taylor's
exercise of which was first
by Lagrange, who proposed to make
ndation of the differential calculus.
works include two treatises on linear
besides contributions to the 'Philo-
ations.'
OR, Charles Fayette, American
h. Williston, Vt., 25 April 1827; d.
es, Cal., 25 Jan. 1899. He was edu-
public schools and was graduated the
University of Vermont. He next
New York studying the new 'Swedish
ystem which he learned from Dr. Lo
cation became of the deformed and crippled in
achieved a great reputation and
New York Orthopedic Dispensary,
ted the Taylor splint for spinal
also the long extension hip splint.
s works are 'The Theory and Prac-
he Movement Cure,' 'Mechanical of
Joint Disease,' etc.
OR, Charles Henry, American jour-
Boston, 14 July 1846. He made
instructor and reporter private secretary to the government of
etts for three years. He served dur-
War with the 38th Massachusetts
and was lieutenant-colonel on the
orner Claffin. He was member of
the legislature in 1872, and in 1873 became
manager and editor of the Boston Daily Globe. He built up the property and made it one of
the most influential journals of New England.

TAYLOR, Charles Jay, American artist:
b. New York, 11 Aug. 1853. Attended College
City of New York, afterward graduated at
Law School, Columbia University (1874),
LL.B., subsequently studied art, National
Academy of Design, Art Students League
in London and Paris. Has illustrated many books,
contributed drawings to prominent periodicals
and exhibited at the National Academy of
Design, Pennsylvania Academy of Fine
Arts, World's Fair, Chicago; Exposition Universelle,
Paris; Pan-American, Buffalo, where awarded
medal; Carnegie Institute, Pittsburgh, and at
Panama-Pacific Exposition, San Francisco.
He served on advisory committee on Fine
Arts for the Panama-Pacific, representing
Pennsylvania; also was one of the Inter-
national Jury of Awards, Section of Fine Arts,
for the same exposition. From 1911, pro-
essor of fine arts, Carnegie Institute of
Technology, Pittsburgh.

TAYLOR, David Watson, American naval
constructor: b. Louisa County, Va., 4 March,
1864. He was graduated at the United States
Naval Academy in 1885, with the highest rec-
cord ever made there. At Greenwich, England,
in 1885, he received the highest honors of the
Royal College, repeating the record in 1886.
He was made captain, United States navy, in 1901
and, by 1917, was promoted to rear-admiral.
In 1914 he became chief constructor of the
United States navy and chief of the Bureau of
Construction and Repair.

TAYLOR, Edward Thompson, American
Methodist missionary: b. Richmond, Va.,
December 1793; d. Boston, Mass., 6 April 1871.
At the age of seven he ran away to sea, and
followed the sea until the age of 17. During
the War of 1812 he was captured on a priv-
eteer of war, the Black Hawk, and was taken
to England, being confined in Dartmoor prison.
Being converted, he acted as chaplain in
the prison and after his release, for a time was a
tin and iron peddler, then a buyer of rags and
a farmer. In 1819 he became a Methodist
minister, and in 1828 was appointed missionary
to the Seamen's Bethel in Boston, where he
served for many years, attaining a wide repu-
tation. Here he was called 'Father Taylor' and
was greatly loved by the sailors. In his ser-
mons, which he delivered in the common lan-
guage of his day, he made free use of nautical
terms, and possessed a genial wit. In 1832 he
visited Europe, and delivered many addresses.
In 1842 he visited Palestine, and was chosen
chaplain of the United States frigate Macedonia,
then he sailed with relief in 1846 for the istric
Ireland. Consult 'Father Taylor the Sailor Preacher' (1872).

TAYLOR, Sir Frederick Williams, Cana-
dian financier: b. Moncton, New Brunswick,
1863. He entered the Bank of Montreal
in 1878, becoming successively assistant in-
spector at head office (1897), joint manager of
the Chicago (1903), manager of London branch
(1906), and general manager at Montreal
(1913). He carried through huge banking
loans to Canada during his London services.
He is a director of the Allen Line Steamship Company, Ltd., vice-president of the Canadian Bankers’ Association, etc. For valuable services he was knighted in 1913.

**TAYLOR, Frederick Winslow**, American efficiency engineer: b. Germantown, Pa., 20 March 1856; d. 21 March 1915. Educated at Phillips Exeter Academy, but left on account of eyesight trouble, and was graduated (1883) at Stevens Institute of Technology. In 1887 he entered service at the Midvale Steel Company, Philadelphia, becoming, successively gang-boss, assistant foreman, foreman of machine shop, master mechanic, chief draughtsman and (1889) chief engineer. In the latter year he commenced his notable career of efficiency expert, reorganizing manufacturing plants (shop accounting and sales departments) of which the Bethlehem Steel Company, Cramps Shipbuilding Company, etc., were examples. He was the inventor of the Taylor White process of treating modern high-speed tools, receiving a personal gold medal at Paris Exposition, 1900. Patents granted to him number over 100. He was president of the American Society of Mechanical Engineers, 1905-06. He wrote: *Concrete, Plain and Reinforced* (1905); in collaboration with S. E. Thompson; *Art of Cutting Metals* (1905); *Principles of Scientific Management* (1911); *Shop Management* (1911), and contributed numerous articles on his special topic to *Proceedings of American Society of Mechanical Engineers*.

**TAYLOR, George**, American statesman, one of the signers of the Declaration of Independence: b. Ireland, 1716; d. Easton, Pa., 23 Feb. 1781. Disliking the medical profession, for which he was destined, he came to America as a "redemptioner," and on arriving bound himself for a term of years to an iron manufacturer at Durham, Pa. His education and intelligence being discovered, his employer made him his clerk, and after his death Taylor married his widow and became master of the establishment. He was a member of the provincial assembly in 1764-70, when he was a judge of the County Court and colonel of militia. In October 1775 he was again elected to the provincial assembly and was active in the promotion of revolutionary measures. The action of some of the members of the Continental Congress the next year in refusing assent to the Declaration of Independence, led to the election of new members, 20 July 1776, of whom Taylor was one. He signed the Declaration on 2 August; subsequently negotiated a treaty with several of the Indian tribes on behalf of the United States, and in March 1777 retired from Congress to private life.

**TAYLOR, Graham**, American sociologist: b. Schenectady, N. Y., 2 May 1851. He was graduated (1870) at Rutgers College and at the Reid Theological Seminary, New Brunswick, N. J., in 1873. He was ordained for the Dutch Reformed ministry in 1873, becoming pastor at Hopewell, N. J. From 1880-92 he filled the pulpit of the Fourth Congregational Church, Hartford, Conn. He acted as professor of practical theology at the Yale Theological Seminary from 1888-92, and, since 1892, has served as professor of social economics at the Chicago Theological Seminary. He was founder of the Chicago Commons Social Settlement, which has been resident warden since 1894. He was president of the Chicago School of Civics and Philanthropy and associate editor of *The Survey*. He has written *Religion in Surgery* (1913), besides numerous editorials to *The Chicago Daily News*.


**TAYLOR, Sir Henry**, English poet: b. Bishop-Middleham, Durham, 1800; d. Bournmouth, 28 March 1886. He entered the navy as midshipman, turned after a few months. In 1817-20 he had a small appointment in London. Returning to his father’s country home, he gave himself to serious study, and in 1822 wrote an art for the Quarterly Review. He went to London, and received a clerkship in the Colonial Office, through which he retained his connection for 48 years. He mingled with the intellectual life of the times, contributed to the Quarterly Review, wrote his first tragedy, *Isaac Comenius* in 1827. He was favorably reviewed by *Sartor Resartus*, but failed to attract popular notice. From 1834 he was engaged upon another drama, *Philip van Artevelde*, his principal achievement in literature. It was formed *Elizabethan* models, and has *Mephistophelian* dignity and refinement. His other works include *The Statesman* (1836), *Klopstock* (1835), *Notes upon the Poems* (1847); *Notes from the Virgin Widow* (1847); *A Sicilian Summer* (1850); *Saint Clement’s Eve* (1862), a *koom* drama. His autobiography was published 1885. Consult his *Works* (1878), and *response*, edited by Dowden (1888).

**TAYLOR, Henry Ling**, American geologist: b. New York, 17 March 1837. He graduated (1877) at Sheffield Scientific School and obtained his diploma at the College of Physicians and Surgeons (Columbia) in 1881. His father, Charles Fayette Taylor, specialized on orthopedic branches and was a professor of orthopedic surgery (1902-1907) at the New York Medical School and Hospital. He is consulting orthopedic surgeon at Hartford Hospital, and associate surgeon at the Hospital for Ruptured and Crippled. He was president of the American Orthopaedic Association in 1890.
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iten 'Orthopedic Surgery for Practi-
(1900).

LOR, Henry Osborn, American au-
New York, 5 Dec. 1856. He was grad-
rom Harvard in 1878, received the de-
L.L. B. at Columbia in 1881 and that of
at Harvard in 1912. He has published
on the Law of Private Corporations?...
(1902); 'Ancient Ideals: A Study of
ual and Spiritual Growth from Early
to the Establishment of Christianity',
(2d ed., 1913); 'The Classical Heritage
Middle Ages' (3d ed., 1912); 'The
Mind?' (2 vols., 2d ed., 1914); 'De-
e—the Freeing of the Spirit in the
World' (1915). Mr. Taylor is a mem-
cane the National Institute of Arts and Let-

LOR, Isaac (known as Taylor of
 English Congregational clergyman and
 b. London, 1759; d. Ongar, Essex, 11
 29. He was originally an engraver, but
 the annual and was minister at Colches-
ished many works, chiefly books for the
among which are 'Advice to the Teens';
ing of British Biography'; 'Beginnings
phy of Biography'; 'The Lost?'; 'Book of
arship for the
; 'Bunyan Explained to a Child';
Life of Christ'; 'Mirabilia; or, The
s of Nature and Art'; 'Scenes in
, in Asia, in Europe, in Foreign Lands.'

LOR, Isaac, English writer, son of
 edging: b. Levenham, Suffolk, 17 Aug.
 28, 1865. His
 almost entirely passed in retirement
place where he died, and is only remark-
 the literary work which he produced.
 of 'Elements of
 (1823). It was succeeded by numer-
ers, most of which are of a partly philo-
sely religious cast. The principal
he Natural History of Enthusiasm'
'Ve support of Fanaticism';
'Catholic Despotism' (1835); 'Physi-
ory of Another Life' (1836); 'Ancient
ity' (1839–43); 'Loyola and Jesuit-
9); 'Wesley and Methodism' (1851); 'Re-
ation of Belief' (1855); 'The World of
 (1857); 'Ultimate Civilization' (1860);
it of Hebrew Poetry' (1861). The
these works is that by which his name
ly known, although originally published
ously. The work on ancient Christian-
osed with the view of correcting
which the author believed many were
 fall into in consequence of the appeals
writers of the Oxford tracts to the au-
the practice of the early Church.

LOR, Isaac, English scholar, son of
or of 'The Natural History of Enthu-
 b. Stanford Rivers, Essex, 2 May 1829;
ington, Yorkshire, 18 Oct. 1901. He was
d from Trinity College, Cambridge,
the following year issued a translation
ker's 'Charicles.' It was ordained in
published 'Theology and
. In the latter year he becam
in London, and in 1864 published the
works by which he is chiefly re-
'Words and Places, or Etymologi-
cal Illustrations of History, Ethnology and
 Geography.' In 1869–73 he held a curacy in
a Bethnal Green parish, and his arduous labors
there are described in 'The Burden of
Poor.' He became vicar of Holy Trinity,
Twickenham, in 1869, and in 1875 was pre-
sented to the rectory of Settington, near Mal-
ton, in Yorkshire, which he retained until his
death. In 1879 he first propounded the theory of
the Greek origin of runes in a work entitled
'Greeks and Goths: A Study of the Runes';
and he published in German a treatise 'Ueber
den ursprung des slavischen Alphabetes,' but
his magnum opus, 'The Alphabet: An Account
of the Origin and Development of Letters;' did
not appear until 1883. In 1885 he was appointed
of York. His other works include 'The
Family Pen: Memorials, Biographical and Lit-
erary, of the Taylors of Ongar' (1867);
'Etruscan Researches' (1874); 'Leaves from
an Egyptian Note-Book' (1888); 'The Origin
of the Aryans' (1889); and 'Names and their
Histories: A Handbook of Historical Geogra-
phy and Topographical Nomenclature' (1896).

TAYLOR, Isaac Ebenezer, American phy-
 b. Philadelphia, 25 April 1812; d. New
 York, 30 Oct. 1889. He was graduated
 from Rutgers College in 1830, and in medicine
from the University of Pennsylvania in 1834. He
subsequently studied in Europe, settled in New
York, and had charge of the department of
women's diseases at the City, Eastern, and De-
ern and Demitt dispensaries for seven years
each. In 1851 he was elected physician to Bel-
vue Hospital, where he initiated important re-
forms, secured the foundation of the hospital
college, and became its head, 1861. He was
subsequently president of the medical board
of the hospital; attending physician and head
of the medical board of the Charity Hospital,
and obstetrical physician to the Maternity Hos-
tial. He was the first American to introduce uterine
consolation, helped introduce the hypodermic
method of treatment by morphia and strychnia,
and was the earliest in this country to use the
speculum in diseases of women and children.
He published a monograph on this subject in
1841.

TAYLOR, James Knox, American archi-
b. Knoxville, Ill., 11 Oct. 1857. He took a
special course (1877–79) in architecture at the
Massachusetts Institute of Technology, then
served in New York architects' office three and
a half years. From 1882–92 he practised in
Saint Paul and at Philadelphia from 1892–1905.
In 1895 he was appointed senior draughtsman at
the United States architect's office and
then, till 1897, principal draughtsman. From
1897–1912 he was supervising architect and since
1912 has been director of architecture at the
Massachusetts Institute of Technology, Boston.

TAYLOR, James Munroe, American edu-
cator: b. Brooklyn, N. Y., 5 Aug. 1848. He was
graduated from the University of Rochester
in 1868 and was pastor of a Baptist church in
South Norwalk, Conn., 1873–82, and at Provi-
dence, R. I., 1882–86. In 1886 to February
1914 he was professor of ethics and president
of Vassar College. He has published 'Psy-
ology' (1893); 'New World and Old Gospel'
(1900); 'Practical or Ideal' (1901); 'Before
Vassar Opened’ (1914); ‘Vassar: A History’ (1915).

TAYLOR, Jane. English poet and author, daughter of Isaac Taylor, 1759–1822, (q.v.), b. London, 23 Sept. 1783; d. Ongar, Essex, 12 April 1823. She was educated under the supervision of her father and early displayed literary ability. Her work, which was very suc- cessful, has been much brought to the notice of Cowper. Her first work was ‘The Beg- gar Boy’ (1804) and in conjunction with her sister Ann (Mrs. Gilbert, of Nottingham, 1783–1824), she published ‘Original Poems’ and ‘Hymns for Infant Minds’. Her other work includes ‘Display’, a didactic tale (1815); ‘Essays in Rhymes’ (1816), and (published posthumously) ‘Contributions of Q. Q. to a Periodical’ (1826); ‘Correspondence’ (1825), etc. Consult Taylor, Isaac, ‘Memorials of the Taylors’ Family’ (1871).

TAYLOR, Jeremy, English prelate and author; b. Cambridge, 1613; d. Lisburn, County Antrim, Ireland, 13 Aug. 1667. After graduation in 1630 from Caius College, Cambridge, he was ordained in 1634, attracted some attention lectures at Saint Paul’s School, and was sent by Laud to Oxford, where he was admitted perpetual Fellow in 1636. He was presented to the rectory of Uppingham, Rutland, in 1638, to that of Overstone, Northamptonshire, in 1643. By this time he had made much of a reputation by his casuistical discourses. In the civil war he was committed to the Royalist party. As chaplain in ordinary to the king, he accompanied the army and was taken prisoner by the Parliamentarians in the battle before Cardigan Castle (1645). Soon released, he remained in Wales, having found, as he later said, that the ‘great storm’ had ‘dashed the vessel of the church all in pieces.’ While chaplain to Richard Vaughan, Earl of Clarcy, at Golden Grove, Carmarthenshire, he did some of his best literary work, including ‘The Liberty of Prophecying’ (1646); ‘Holy Living’ (1650), and ‘Holy Dying’ (1651). He was twice imprisoned at Chesham, and occasions preached to small Presbyterian congregations in London and in 1658 was appointed to a weekly lectureship at Lisburn, County Antrim. In April 1690 he signed the ‘declaration’ of the Loyalists and in August following he was made bishop of Down and Connor. He found the troublesomeness of the Presbyterians, who refused to recognize Episcopal jurisdiction. At his first visitation he declared 56 churches vacant, their incumbents not having been episcopally ordained. Contrary to his pur- pose, he contributed greatly toward the establish- ment of Loyalist Presbyterians in northern Ireland as an independent ecclesiastical organization. Of his works, the best known is probably the ‘Liberty of Prophecying’—by which he meant expounding—a defense of toleration. He rests this plea for private judgment the uncertainty and inadequacy of tradition, the fallibility of any arbiter that may be selected on account of controversy, and the diffi- culty of expounding the Scriptures. Coleridge thought the result of the argument was that ‘so much can be said for every opinion and sect’ that appeal must be made to some positive jurisdiction on earth.’ Perhaps Taylor’s was merely a ‘legal settlement.’ At it is otherwise inconsistent with his work in Ireland. But he was at his best accurate theologian or polemistr as but as of righteousness. His literary work, generally thought to be seen in his sermons. They do not lack — redundancy, diffuseness, a love of quotation and illustration; they were always eloquent, with a certain vivi- nity and solidity for which many have been unable to find an equal. His devotional works, inspiring fori- ney, are also highly valued by his followers. Next to the ‘Liberty of Prophecying’ and now the most widely read are collected editions by Bishop Heath (22) and by Eden (1847–54). (See 1: 177; 22: 186.)

TAYLOR, John, English poet; b. Hertfordshire, 24 Aug. 1580; d. London, 1653. When young he was taken to Oxford and apprenticed to a waterman, henchman of the ‘water-poet,* by which he is known. He was at the taking of the Earl of Essex, in 1596, and afterwards in Germany and Scotland. At home he was years collector for the lieutenant of Oxford, and his fees of the wines and the ships which were captured. When the civil war broke out he lived in London, where he kept a common house, and wrote pasquinades upon the heads. He afterward kept a public house near Westminster. Certain of his works were published under the title ‘All the Works of Taylor, the Water-Poet, being Sixty and Number, collected into one volume;’ revised, and new parts added (1618). They were subsequently increased to 130, a very large number. They are not of natural humor and of the jingling prevails so much during the reigns. It as a mirror of the coarse manners of the times they are invaluable to the history of antiquity.

TAYLOR, Joseph, a high priest by Joseph 1832 and in 1882 went as a Mormon to various parts of the British Isles. Thy thing he returned and settled at III, where in 1844, in company with other Mormon leaders, charges of disloyalty were brought against Carthage jail where the prisoners were attacked by a mob, two of them were killed and he was
TAYLOR

uring from a second mission to 46 he went to the new Mormon Salt Lake City and in 1849 was licute judge of the Mormon State. He subsequently translated and 'Book of Mormon' in French. In 1854 he was elected a mem- ber of the legislature on New York, published 'The took charge of Mormon follow- yst. From 1877 to 1880 he was the Twelve Apostles and in the signed the first presidency and the and took the chief place himself. He was among those indicted grand jury under the Edmonds naineed in concealment until his

, John Louis, American jurist: England, 1 March 1769; d. Raleigh, 2 Nov. 1829. Arriving in this country in 1804 he gained an education at Mary College, Virginia, and was bar after reading law with- fe general and Fayetteville and be- fore the legislature (1792-95). Sworn (1796) he was appointed of the Superior Court, a posi- for 20 years, being chief justice he time. In 1821 he was elected ied justice of the Supreme Court of Alabama. He was appointed (1817), Judge Henry Potter, to revise the work 'Potter's Revival' of the Constitution of the State, which caused the work 'Potter's Revival' to be known as 'Taylor's Revival.'

, Mary Inlay, American novelist: D. C. She has published 'Lover'; 'A Yankee Vole'; 'The Cardinal's Musketeer'; 'Cobbler of Nimes' (1900); 'Little Mistt; Good' (1901); 'The Rebellion of the Red Staircase' (1900); 'The Reapings' (1908); 'Caleb Fich'; 'Long Way' (1913). She is also author of the photoplasys, 'The Ploughing Wilson'; 'Daughter,' etc.

, Nathaniel William, American clergyman: b. New Milford, e 1786; d. New Haven, Conn., 10 May 1876. He was graduated at Yale in 1823 and later became the pastor Congregational Church at New high position he continued until he resigned to become professor of 'ale. This chair he held during his life. He maintained the theology, especially on the tality of depravity, which was regarded led him into a controversy with the al branch of the Congregational 8-30. His works were edited and Noah Porter (1858-59).

, Philip Meadows, English mili- tary author: b. Liverpool, 28 Sept. ston, France, 13 May 1826. He tizan's army in India in 1824 and in 1841 was made administrator of the state of Shorapore, subduing its rebellious ruler. He rendered valuable service in keeping order during the berar mutiny in 1857, for which he was promoted to the rank of colonel. He published 'Confessions of a Thug' (1839); 'Tara' (1863); 'Ralph Darnell' (1865); 'Manual of the History of India' (1870); 'A Noble Queen' (1878), and other works. His autobiography was published in 1877.

TAYLOR, Richard, American soldier, son of Zachary Taylor (q. v.): b. New Orleans, La., 27 Jan. 1826; d. New York, 12 April 1879. He was graduated from Yale in 1845, after which he went to his father's camp on the Rio Grande and was present at Palo Alto and Resaca de la Palma. He sat in the Louisiana senate in 1856-60 and was a member of the Louisiana Seces- sion Convention. He aided in the organization of the Confederate troops, commanded a brig- ade under Stonewall Jackson and fought at Front Royal, Middletown, Winchester, Stras- burg, Cross Keys, Port Republic and also in the seven days' battle before Richard. He was then promoted major-general and appointed to the command of Louisiana, where he suc- ceeded in strengthening the Confederate posi- tion, an advantage which was lost by the fall of Vicksburg in 1863. On 8 April 1864 he met and defeated General Banks at Sabine Cross Roads, but on the following day lost his advantage and was in his turn defeated. He was pro- moted lieutenant-general in 1864 and placed in command of the Department of Alabama and Mississippi. After the surrender of Lee and Johnston he capitulated to General Canby at Citronelle, 8 May 1865. He published 'Destruction and Reconstruction' (1879).

TAYLOR, Robert William, American physician: b. London, England, 11 Aug. 1842; d. 1908. He was graduated at the College of Physicians and Surgeons, New York (1868) and started practice in that city. He was professor of diseases of the skin at Woman's Medical College, New York, and in the medical department of the University of Vermont; also surgeon in the venereal department of Charity Hospital, Bellevue Hospital, New York Dispensary, etc. He wrote 'A Practical Treatise on Sexual Disorders of the Male and Female' (New York, 3d ed., 1905).

TAYLOR, Rowland, English martyr: b. Rothbury, Northumberland; d. Hadleigh, Suffol, 9 Feb. 1555. He was graduated at Cam- bridge University and appointed by Cranmer, to whom he was domestic chaplain, rector of Hadleigh and he became archdeacon of Exeter and a canon of Rochester. Under Mary he was imprisoned, as a heretic, for more than a 12-month and on being condemned to the stake suffered at Hadleigh. Consult Cooper, 'Athenæ Cantabrigienses' (1858).

TAYLOR, Thomas, English scholar: b. London, 15 May 1758; d. Walworth, 1 Nov. 1835. He was educated (with the idea of be- coming a Dissenting minister) at St. John's College, London, but entered a banking house as clerk, and subsequently served for several years as assistant secretary to the Society for the Encouragement of Arts, Manufactures and Commerce. On the condition of his devoting himself to literary work for the last 40 years
in the Seventh United States infantry. He was made a captain in 1812 and in the 1812 gained distinction in defeating attack on Fort Harrison, for which he was brevetted a major. In May received a regular commission as left the service at the close of the time. Having returned to the army in 1816 and in 1819 voted to a lieutenant-colonelcy. For few years he was stationed at different posts but in 1832 during the Black War, as colonel, received the surrender of the Seminole. In 1832 he was ordered to the Seminole campaign and to the Okeechobee (25 Dec. 1837) won victory over the Indians, for which he received a brigadier-general. Taylor next four years in Florida and was a command of the First Department ny with headquarters at Fort Jessup. 8 May 1845. Taylor, in command of the Southwest, was ordered toelf in readiness to defend Texas from invasion should the latter State ac- cepts of annexation. On 30 July 1845 ordered to occupy, protect and des-and to approach the Rio Grande s of Texas and Mexico but not to enter both countries (Texas and Mexico). At the time he was cautioned to keep the Mexican settlements and posts.

Taylor selected a position at Corpus Christi on the Nueces. He then followed a series of orders from the War Department to check any Mexican endeavor to cross the Rio Grande and to do so. Taylor reported there was no concentration of Mexicans on the Rio Grande or any signs of war, but, beginning to understand the administration's intention, asked for definite orders to discontinue the War Department refused to do so for a few months a delay ensued between the Mexican government. At last, instructions from Washington, 1846. Taylor began his advance up Christi to the Rio Grande. On e arrived opposite the Mexican and began the construction of a fort, afterward called Fort Brown, upon the site of Brownsville. Taylor blocked the Rio Grande with a view of all supplies from Matamoras and many Mexican troops stationed there withdraw or to assume the offensive. General Ampudia summoned him beyond the Nueces, and with Taylor's do so the first conflict occurred on 23d our territory and shed America in the American soil. The President sent the boundary of the United States, Mexican回复 oe the American and Mexican replies.

On 2 May 1842, Taylor occupied Matamoras (18 May). With the refusal of Mexico to negotiate, Polk determined to conquer the northern provinces and in August, Taylor resumed his advance and after a three days battle captured the city of Monterey (21–23 September). By this time Polk began to distrust Taylor on account of his supposed Whig affiliations. It was em- nursing for a Democratic administration to have a Whig general reaping all the glory, and with a view toward checking his operations Polk detached most of Taylor's experienced troops for the intended advance upon Vera Cruz under Gen. Winfield Scott. Santa Anna, the Mexican commander-in-chief, learning of Taylor's weakened condition rapidly concentrated 20,000 men and marched northward to crush him. To retire to the Rio Grande meant a loss of all the prestige so far gained and, therefore, Taylor decided to fight. He took a position at the hacienda Buena Vista, five miles south of Saltillo. Here after three unsuccessful attempts by Santa Anna, Taylor gained the most decisive victory of the war and remained in undisputed possession of the region. Taylor's brilliant victory, handicapped as he had been by the authorities in Washington, suggested him as a possible Presidential candidate to the Whig politicians. Thurlow Weed learned from the general's brother, Polk, that Taylor had always been an admiring of Clark and preferred home-made goods to foreign importations. Taylor meetings became the fashion throughout the country, he was nominated at public assemblies in Ohio, Kentucky, Virginia, Pennsylvania and elsewhere, and although he had never even voted and had no views on political topics, supported by Weed, Crittenden and Stephens, he gained the nomination at the Whig Convention (May 1848) over the claims of Webster and Clay. In the succeeding campaign Taylor carried eight slave States while his opponent secured seven. The one all-absorbing question after the inauguration of Taylor was the question of what should be done with slavery in the Territories. Both parties in the campaign had side-stepped the issue, the Whigs having adopted no platform and the Democrats having trusted to the well-known views of their candidate, Lewis Cass. President Taylor, although master of a plantation in Louisiana, admitted anti-slavery leaders in the Whig party to his counsel and William H. Seward became his confidential adviser. The Wilmot proviso, the question of the organization of the Territory of Oregon and the admission of California already had demanded immediate attention. Accordingly the first message of the President was awaited with interest. Taylor already had made up his mind to recommend the admission of California as a free State and his fatherly manner breathed with devotion to the Union. But Clay and Webster determined to take matters into their own hands and in January Clay offered his plan of compromising the sectional issue. Taylor characterized the Territorial portion of Clay's measures as the "Omnibus Bill" and was preparing to oppose them when he died on 9 July 1850.

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R. C. McGARREY.
TAYLOR, Pa., town in Lackawanna County, on the Central Railroad of New Jersey and the Delaware and Lackawanna Railroad. It is situated three miles southwest of Scranton, its chief industries being coal-mining and oil mills. Pop. in 1900 was 4,215 and in 1910, 11,591.

TAYLOR, Tex., town in Williamson County, on the Missouri, Kansas and Texas and the International and Great Northern railroads, about 30 miles northeast of Austin, the capital of the State. It is in an agricultural and stockraising region. The chief manufacturing establishments are cottonseed-oil mills, cotton-compresses, railroad shops, flour and planing mills. There are about 75 manufactories, with an annual output of over $500,000. There are good banking facilities and newspapers. There are large shipments of grain, vegetables, cotton products, fruit and livestock. Pop. 5,314.

TAYLOR INSTITUTION, Oxford England, connected with the university, is designed mainly for the promotion of the study of medieval and modern technology. It owes its foundation to a bequest of Sir Robert Taylor. The building belonging to it was erected in 1848. The institution comprises four teacherships of modern European languages and a library, and there are in connection with it a school of art and an exhibition. It is under the management of nine curators, all of whom must be members of convocation. The library is open free to all members of the university, and other literary persons may be admitted by permission. The curators of the institution have also the administration of a fund bequeathed by William Thomas Horner for the encouragement of the study of the Polish and other Slavonic languages.

TAYLOR UNIVERSITY, located at Upland, Ind. The forerunner of the university was the Fort Wayne Female College, organized in 1846 at Fort Wayne, Ind. In 1852 this college united with the Collegiate Institution at the same place, and became a coeducational school. The name was changed to Taylor College in 1860. In 1893 a new charter was obtained, and the university moved to its present site, the citizens of Upland donating 10 acres of ground and $10,000. It is under the control of the National Association of Local Preachers of the Methodist Episcopal Church. It was named for Bishop Taylor, the first Methodist missionary bishop to Africa who had a part in its organization. The departments of the university are the college of liberal arts, the academy, commissioned by the State as a high school, the Red Bridge theological seminary, the school of music, the school of expression, the normal department and the commercial department. The college offers two courses, classical and scientific, leading respectively to the degrees of A.B. and B.S. A part of the work of each course is elective. The theological school offers two courses; the English Bible and the seminary course, leading to the degree of B.D. A very strong school of music accredited by the State Teachers' Association has a separate building. The course in expression requires four years. The commercial department offers two courses: bookkeeping and typistry. The spirit of the college is religious, a number of graduates have become missionaries; and the studious organizations are strong. The library contains 7,000 volumes. The students annually 340 and the faculty 19.

TAYLORVILLE, Ill., city, county of Christian County, on the South Fork Sangamon River, and on the Wabash and Baltimore and Ohio Southwestern; about 24 miles southeast of Springfield; miles southwest of Decatur. It is in a cultural and coal-mining region, and considerable manufacturing interests. There is a foundry, paper mill and manufactured wagons, agricultural implements, cistern and tile. The chief shipments are hay, livestock and manufactures. The eight churches, a high school, graded and a public library. There are three one national with a capital of $80,000, private banks. Pop. about 5,446.

TAYRA, ti-ra, a brown, elongated, like fur-bearers from the American north and South America, which sometimes large bands. It has a long bushy tail.

TAYTAY, ti-tay, Philippines, (1) a province of Paragua, island of Palawan, the northwest coast on Taytay Bay. It has one town of the province and is protected by a fort mounting several guns and capable of accommodating a garrison of 700. Agriculture and fishing are the chief industries. (estimated) 7,420. (2) Pueblo, prov. Rizal, Luzon, 10 miles east of Manila.

TAYUG, ti-yug, Philippines, province of Pangasinan, Luzon, in the extreme northwest of the province, near the Agno 34 miles east of Lingayen. It is on the way from San Quintin to Asefanan.

TCHAD, chad, or CHAD, Africa, lake in the Sudan, situated at the junction of Kamerun and the French Sahara, lat. 13° N., long. 14° E., about 750 feet above sea-level. Its area in the rainy season is about 30,000 square miles, but in the dry season it shrinks to 7,000 square miles, and is then a vast marsh, while the remaining water is shallow. The water is drinkable, although lake has no apparent outlet; it appears gradually draining up and liable eventually to a desert. Rarely is more than 20 feet of water to be encountered, and the marsh increase in size.

TCHAIKOVSKY, ch Kay'夫, the greatest of Russian composers, Voronezh government of Viatka, 7 May 1840; d. Saint Petersburg, 1893, of cholera. His father, a mining engineer, had no intention of making a musician, but had him educated at the Technological Institute in Saint Petersburg, after leaving he obtained a post in the Ministry of Education. In 1861 he wrote to his sister: 'Tell my old teacher and music critic that I am writing the theory of music with conscientious attention.' He became a professor at the Imperial Academy of Music in 1867, and later was appointed director of the St. Petersburg Conservatory.
It is generally agreed that with my in talents (I hope you will not take mere boasting) it would be a pity not your luck in this career. Shortly there- 1 entered the Conservatory, where he at the action of an Anton Rubi- no refuses that the government gives the young students to com- e and asked him to write a set of on it. He expected about a dozen, ikovskv brought him over 200! From he also took lessons in orchestra- instruments on which he practised piano and the organ; also the flute, he afterward made such admirable T'\ Nutcracker Suite' and other works. it was ere long generally appreciated; Laroche, afterward an eminent critic, to him as 'the future star of Russian his led to his being sent to Moscow in each the theory of music at the newly Conservatory. Although he disliked it, he proved a conscientious and demanding student. He had the courage to eschew the most rare time to composing; but although an almost feminine craving for ap- nd encouragement, his experiences be more than a series of disappoint- His wordly prospects were never most improved and in 1877 he married, to rise of his friends. The hasty mar- l a tragic sequel. The union was not one, and the pair soon separated. The was so despondent that he attempted to commit suicide in such a way as to avoid standing up to his chest in the icy night, in the hope of catching a cold. In the following year another influenced his life, in a happier way: not know her, and she preferred to identity concealed, but she put aside ene a sum of money which made it for him to give up his Conservatory and save his energy for his creative lany master-works now came from his had never cared for society and de- ty life, so his friends were not sur- ed, in 1885, he took a house near the Klin, where he was isolated as a character. Wagner when he 'Meistersinger' score in his villa near he became known as 'the Hermit of d refused to see any one but friends musicians as he chose now and then for a party. By constitution he was irritable and not easily fatigued; he was outdoor exercise and many of his deals came to him on his walks. He ch as he neared his 50's; his count v white and his face lined. In May visited America and gave concerts in and other cities. Two years later acted some of his works at Oxfordived the degree of doctor of music university. In the autumn of 1893 d was startled by the news of his he succumbed to an attack of cholera, short illness. There were rumors of committed suicide, but his friend rapher Kashkin disabused those. Suicide rumors were strengthened by euter of his last symphony, which is own throughout the world as the most lugubrious of all sym- phonic works. A more heart-rending wail of grief than its adagio lamento has never been heard; and as this slow movement, contrary to all precedent, closes the symphony, it seemed like an intentional farewell to the world. This music, says Huneker, is a page torn from Ecclesiastes; it is the cosmic music of the Schubert once said that the world liked best those of his songs which were born of sorrow. It was the doleful sixth symphony that made Tchaikovsky famous. Seldom has a work so great and deep won such instantaneous and success—a success so remarkable as to unduly over- shadow his other five symphonies except, to some extent, the fifth, which resembles the sixth in mood and music. Like Beethoven, Tchaikovsky is greatest in his orchestral works, which include, beside the six symphonies, seven symphonic poems: 'The Tempest'; 'Francesca da Rimini'; 'Manfred'; 'Romeo and Juliet'; 'Hamlet'; 'Fatum'; 'Le Voyevode.' In these, which contain some of his best and most mature music, he manifes his devotion to the art of Liszt and program modern music. Among his other orchestral works the three that have become most famous are the '1812' overture, the 'Marche Slave' and the 'Nutcracker Suite,' which contains the best musical numbers of one of his three ballets. His 11 operas are much less modern in spirit and structure than his symphonic works and the only one of them that has attracted much attention outside of Russia is the fourth, 'Eugene Onegin.' It has been said of his operas that 'just as the gracious beauty of Italian melody seemed doomed to pass away under a new dispensation, it was reincarnated in the works of this northern composer.' There is much beautiful melody also in some of his 100 lyrical songs; the best known of them are the 'Spanish Serenade,' 'None but a Lonely Heart,' 'Why so Pale are the Roses.' Not a few of the songs are pot- boilers and the same is true of many of his piano-forte pieces, the best of which, however, deserve to be better known. Pianists neglect them because of their awkward technique. Three piano-forte concertos, a violin concerto, a string sextet and other pieces of chamber music must be added to his positions. His work as a whole is characterized by a remarkable variety; now it is classical, even old-fashioned, now ultra-modern; now Russian, now cosmopolitan. German critics have described his symphonies as rough, patchy, barbarous, nihilistic; but music lovers the world over are showing a keener insight and are learning to love this Russian music as they learned to love the Polish music of Chopin, the Hungarian of Liszt, the Norwegian of Greig. The authoritative life of Tchaikovsky has been written by his brother Modest. A shorter volume (in English) by Rosa New- march, includes extracts from his critical writings and diaries. Consult also Kashkin, 'Reminiscences'; Huneker, 'Mezzofanti in Modern Music'; Riemann, 'Geschichte der Musik seit Beethoven.' A 'Catalogue Them- atique' of the compositions is issued by Jur- genson, Moscow.

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Musical Editor New York 'Evening Post.'

TCHERKHOV, Anton P. See TCHERKHOFF;
CHERRY ORCHARD, The; and SEA GULL, The.
TCHIKUN, an American Indian tribe of the Apache (q.v.) family, formerly residing at Hot Springs, N. Mex.

TE DEUM LAUDAMUS, té dé'-úm lá'-dá'-mús, or more abbreviated, TE DEUM, is the beginning of the hymn of praise usually ascribed to Saint Ambrose and Saint Augustine, although it cannot be traced as far back as the end of the 5th century, while Saint Augustine died in 430. The opening words, meaning, "We praise thee as God," show that it was originally a hymn to Christ, but it is now always regarded as a hymn to the Father, the English version beginning, "We praise thee, O God." In addition to its place in church services it is often sung on particular occasions, as on the news of victories and on high festival days. Among the great composers of music for this hymn are Hasse, Naumann, Haydn and Handel.

TEA, an evergreen shrub or small tree (Camellia thea) of the order (Theaceae). The plant naturally attains a height of 30 feet, but under cultivation is pruned so that it rarely exceeds 12 inches in height. It bears alternate leaves, about four inches long and rather large fragrant white flowers singly or in twos or threes, mostly in the axils of the leaves. It is a native of India and China, and has been cultivated in the latter country more than 2,000 years. Of several recognized species, only two have become commercially valuable: C. thea, var. Bohea, and C. thea, var. viridis. The latter is indigenous to India, the former recognized as a hybrid of Chinese species, probably with the original India variety.

Cultivation. - The ground on which a plantation of tea is to be set out is dug over in trenches to the depth of at least 18 inches, and 24 inches is preferred if the expense — about double — is not deterrent. As the plantation is of a permanent character, intended for a productive period of probably 30 years, every effort is made to have the soil in the best condition, and well manured. The plants are taken from a nursery where they have been grown from seed for six to 12 months, and set four feet apart both ways for "hill" culture. Where the ground is especially favorable they are set five feet apart. On poor soil the "hedge" system is practised, the plants being planted 18 inches apart in the hedge, and the hedges five feet apart. The plant has a tap-root descending eight to 10 feet into the earth. From this the feeding roots ramify in all directions. The cultivation consists in keeping the ground loose and free from weeds by surface hoeing, and once a year trenching the soil — from 18 inches in depth between the rows to nine inches next the "collar" of the plants. This is done in the late autumn, just after pruning, and the pruning along with green manure, preferably from leguminous plants, are spread under. These prunings are estimated to restore to the soil: 95 pounds of combined nitrogen, 56 pounds of phosphates and 190 pounds of phosphoric acid per acre. The pruning is done while the plant is passive, usually in December. On the hill plantations pruning is done annually, on level gardens, every other year or every third year; the practice being to prune alternate one-half or one-third of the plantation. The unpruned trees furnish the smaller leaves and, therefore, the higher grade tea, and flushes come earlier, thus extending the season. On new plantations pruning when the trees are 12 to 18 months old, at time the centre stem is cut down to the branch, or even six inches above the ground, the object being to produce a growth of branches and shoots of leaves which may be plucked without in the plant. The second pruning takes off a thing to a level of 18 inches above the ground. As much of the tea is picked by children the yield is about 150 pounds per acre. The yield of about 400 pounds per acre begins the fifth year. The plant continues to grow well until its 10th year, when it is cut and new sprouts developed from the bud-stems removed at the first picking. The plantations are pruned about 30 times during the season, with the obtaining the leaves while they are in the best condition. The bud produces the quality of tea; the partly open buds being slightly less valuable. The next leaves below distinctly coarser than the bud leaves. It is inadvisable to pluck the bud and the first leaves. Many growers, however, do not pluck the bud and the first three leaves. The first few crops are thus very large, but the remainder of the season are relatively small. The quality, however, does not wholly depend upon the plucking, but depends upon the soil and the climate. The average weight of two and one-half ounces of fine tea per plant per season.

Processing. - The leaves after plucking is determined by the number of leaves of tea to be produced. In black tea the leaves are wilted or on trays in a draft of cool air orduced by fans. This is continued until the leaves are soft and flaccid. The average time for withering is 18 hours. Less time is required if not sufficient development of the enzyme required for the subsequent fermentation upon which the flavor of the tea so largely depends. Withering is followed by rolling on tables of granite, the motion of the leaves being to crush the cells of the leaf and break its structure. In this process the leaves are rolled, pressing the leaves incidentally receive the active twist necessary in finished tea.
upied in rolling is from 20 to 40 min-
be leaves are then run through a sifter
rades them into sizes, and then are
upon glass or glazed-tile tables to fer-
During this process they are usu-
this freshly wrung out of cold water.
re required for proper fermentation de-
pon the previous development of the
during withering, and may take from
six hours. The temperature is kept
usually 85° F. or slightly below, and
of completion is determined by the
ich at first resembles chopped cabbage,
mes fruity, resembling that of fine ripe
ightly fermented tea yields when a
pole, puntng infusion, the pun-
te to an excess of unfermented tannin.
mented tea yields a deep-colored, soft-
luor of good body. The best tea is
ch receives a medium fermentation and
sequence a brisk taste, with high
of "true green." The first stripping of
ng the leaves rapidly to check further
. The trays go first to a position
 furnace where the temperature is
hence travel away from the source
ng away. At many factories a second firing is
er a few days, and this is considered
se the ultimate quality of the tea as
 into the market after overseas trans-

nce packing the finished tea is sorted
and, vagrant bits of stalks and red
re removed. It is then sifted into
In the ordinary factory these are five:
Orange Pekoe, Orange Pekoe, Pekoe,
chong and Pekoe Fannings. The first
ed almost wholly of terminal buds and
ions of the youngest and tenderest
es; the second is of the smallest leaves
ud buds; the third and fourth grades
re coarser leaves, and the Souchong is
pped up to show a smaller range of
he market. The Fannings are the finer
is and dust, used chiefly in the manufac-
f of cafeiieine, or of "brick tea."

Tea.—In the manufacture of green
frendly, a green leaf is spread out di-
to a roasting pan at a temperature of
id are kept tossing about until
they are emptied upon a mat of
rolled by hand. They are then
ickly over a charcoal fire. The older
re deficient in proper color and are
ith small quantities of Prussian blue,
soapstone. The former leaves are called
green," or "unfinished green," in con-
h the doctored leaves, which go under
of "true green" or "finished green."
ging tea is prepared by a combination
methods, being slightly withered and
rmented and then treated as for green

Tea is a condensed preparation of
the leaves and even the prunings of
. These are panned and steamed,
aced in piles under cloth covers. A
ferment resembling a black fungus
through the mass, which is then sorted,
ith a glutinous rice paste, lightly
and then pressed into molds four
nine and one-fourth inches wide and
four and one-fourth inches deep. Three
bricks are made in this depth, containing
when dry four and one-half pounds each. An-
other form of brick tea is made into tablet
form, four and one-half inches square and one-
and one-fourth inches thick and weighing half
a pound each.

Tea Culture in the United States.—In the
United States the first tea shrub was planted at
Middleton Barony, S. C., in 1800 by the French
botanist Micheaux. It was still living at the
close of the 19th century, when it was about 15
feet high. In 1848 experiments were made upon
an extensive scale by Junius Smith of Green-
ville, S. C., and in 1858 the government engaged
Robert Fortune to collect tea seed for distri-
bution in the South. These experiments were cut
short, the former by the death of the experi-
menter, the latter by the Civil War. About
1880, the United States Department of Agri-
culture commenced experiments which were
abandoned owing to the want of a
chness, a short distance and the
nizing headquarters.
About 10 years later Dr. Charles U.
Shepard of Summerville, S. C., devoted his
private means to tea experimentation. His opin-
ion was that the previous experiments had not
been conclusive and that the production of high
grade teas at a profit to the grower could be
accomplished in many Southern States and that
a demonstration would attract capital to the
industry. Once demonstrated as profitable he be-
lieved that the industry would furnish employ-
ment to many thousands of people, especially
women and children, and would make valuable
large areas of land which yielded little or noth-
ing. In 1900 he had about 60 acres planted to
this crop, a factory fully equipped, a trained
band of pickers and facilities for meeting every
require of planting to final sale. In 1900
the yield was about 5,000 pounds and when the
present area reaches full bearing the annual
output should be more than 12,000 pounds.

The tea plant, though a native of a sub-
tropical climate, will succeed at high elevations
in tropical countries and some of the numerous
varieties will even withstand frost. In South
Carolina the plants have resisted a temperature
of zero, but the yield was lessened about 50 per
cent. In 1902, after two years, this is the lowest recorded tem-
perature in that locality during 150 years.
Ample water, especially during the leaf-forming
season, is essential. This is supplied in the
East by copious rains, but in the United States,
where the rainfall is less than one-half the
Eastern annual average, the deficiency is made
up by improved methods of tillage or by arti-
ficial irrigation or both. In the East the tea
gardens are generally planted on high ground
or slopes so as to permit the excess water to
seep away; in America they are planted on
rather low ground such as well-drained pond-
beds and swamps. Such lands are also natu-
ral rich as a rule and, therefore, demand less
initial application of fertilizers.

History.—The history of the tea-growing
industry is said to have commenced in Korea
before the 4th century before Christ, and to
have reached Japan more than 1,000 years later.
Tea was unknown to Europeans until the 16th
century when Maffel, a Portuguese, mentions
it in his "Historia Indicis" as a product of
Japan and China. Not until 1615, however, was
it mentioned by an Englishman, when Wickman wrote about it in a letter now owned by the East India Company. During that century small quantities found their way as presents to wealthy Londoners or later into the markets where they could command £1 to £5 a pound. In 1657 a considerable quantity was purchased by Thomas Garraway, who opened a sort of restaurant where the beverage was served. As the importations increased, the customs and the excise each affixed duties. At one time (1660–89) a duty of 8d. a gallon was levied upon the beverage. And somewhat later 5s. plus an ad valorem duty of 5 per cent was also operative. The American tea trade began in 1784 and within three years had developed to more than 1,000,000 pounds. The first direct importation from Japan came from Yokohama to San Francisco in 1868. Since 1870 the annual average importation is somewhat in excess of $15,000,000.

From the beginning of the commerce in tea, China has held first place as a producing and exporting country. The choicest grades, however, are probably unknown in America, but are consumed mostly at home or in Russia, where they command enormous prices. The reasons assigned for the non-exportation to distant countries are that the quality usually deteriorates during long transportation, and that some kinds do not keep well unless highly *fired,* a process which impairs their flavor. The industry attracted the attention of the English in India and in 1836 Royle and Faloono, British botanists, commenced in Ceylon to experiment upon an extensive scale. The result was several brands of tea which were superior to many of the Chinese teas. Ceylon began to market tea in 1873 and the industry there has continued to thrive. Tea has been grown more or less in other sub-tropical and tropical climates, notably in South Africa, where somewhat more than a domestic supply is raised.

The large number of plants whose leaves have been used as substitutes for tea may be grouped as resembling or not resembling the real plant in composition. The best known of the former are as follows: Maté, Paraguay tea, Jesuit’s or Saint Bartholomew’s tea, which is obtained from the leaves of a South American species of holly (*Ilex paraguariensis*). This is extensively used in various South American countries, especially in the Argentine Republic, where the annual consumption is estimated at 13,000 pounds per capita, or about 29,000,000 pounds. Kola nut, coffee leaves and guarana are also used, but to a smaller extent. The principal substitutes unlike tea are probably Siberian tea (*Narcissus crassifolius*), Chilean tea (*Eugenia ungii*), Appalachian tea (*Prinos glabrata*), Labrador tea (*Ledum balsamii*), and New Jersey tea (*Ceanothus americanus*). The last was used during the War of Independence and also during the War of the Rebellion. It is described as a good substitute for indifferent black tea. The leaves of the partridge berry (*Mitchella repens*) are sometimes used in America.

In conservatories and greenhouses tea is often grown as ornamental plants and as ornamental shrubs. The tea geranium, a hybrid like their close relatives, the camellias, but are less popular because more limited in their uses, especially because their flowers are auxiliary and hence less useful for cutting than those of the camellias.

**Production.**—The world’s annual production of tea, a pound, amounted to something over 800,000,000 pounds. The World War severely affected production and shipment of the crop that it is necessary to take the figures of production for 1912, as being the latest complete record under normal conditions, to form an accurate idea of the tea-growing industry. In that year the area devoted to tea were as follows: China, 5,120,000 acres (approximately); India, 575,000 acres, of which 354,276 acres were in Assam; Ceylon, about 359,000 acres; Java, nearly 100,000 acres; Japan, about 100,000 acres; South Africa (Natal and Nyasassland) about 6,400 acres. The crops sold in the world’s markets from these producing countries amounted to a grand total of 731,000,000 pounds, contributed thus: 1

- China, 112,000,000 pounds;
- Ceylon, 193,000,000 pounds;
- Java, 65,000,000 pounds;
- Japan, 43,000,000 pounds;
- Formosa, 25,000,000 pounds.

**Consumption.**—The chief purchasing countries of the 1912 crop were: United Kingdom, 295,000,000 pounds; Russia, 147,000,000 pounds; United States, 83,000,000 pounds; Canada, 34,000,000 pounds; Australia, 29,000,000 pounds; Holland, 12,000,000 pounds; Germany, 9,000,000 pounds; New Zealand, 7,000,000 pounds; South Africa, 7,000,000 pounds. In per capita consumption the British Empire as a whole was remarkable in degree the largest consumer, the average being 6.2 pounds, about 10 times the per capita consumption of all the rest of the world put together (excluding the United States). For the individual countries the per capita consumption figures were:

- New Zealand, 7.4 pounds;
- Australia, 6.8 pounds;
- United Kingdom, 6.4 pounds;
- Canada, 4.3 pounds; Holland, 2.1 pounds;
- South Africa, 1.2 pounds;
- United States, 0.9 pound; Russia, 0.8 pound; Germany, 0.1 pound; France, 0.07 pound.

**Infusion.**—As found in the market tea yields from 31 to 49 per cent of its substance in an infusion with boiling water, the Indian tea giving slightly more than the Ceylon teas, and the China teas slightly less. In this water extract the tannin constituent ranges from 14.3 per cent in India teas and 12.29 per cent in Ceylon teas to 9.50 per cent in China teas. (With thorough fermentation the proportion of tannin would fall below 5 per cent.) Caffeine varies from 2.78 to 3.84 per cent in India teas, and ranges up to 4.14 per cent in Ceylon tea and 4.91 per cent in tea dust. In making the infusion for beverage purposes the finest flavored tea is produced by pouring freshly and actively boiling water upon the dry leaves and allowing it to stand not longer than one and one-half minutes, when the infusion should be immediately poured off the grounds. This brief infusion is sufficiently long to absorb practically all of the delicate essential oil which gives the tea its particular flavor. It is also long enough to dissolve out sufficient of the tannic acid to make the taste sprightly, without being astrigent. The infusion will also contain about four-fifths of the contained caffeine. The strong, high quality preferred by tea drinkers is gained by a five-minute infusion.
TEA, VARIETIES OF—TEACH

TEA-NOTE. The importation of tea into the United States for the fiscal year ended 30 June, 1898, reached the record figure of £1,314,933, despite the great difficulties of a scarce and expensive ocean tonnage. The value of the tea was $30,889,030. Of the whole, 4 pounds came from China; 44,546,467 from India and Ceylon, and 21,082,866 from Japan.

Osteology. Bald, C., 'Indian Tea: Its and Manufacture' (Calcutta 1817); E. A. 'Tea' (London 1812); Gray, W. H., 'Tea' (New York 1803); H., 'Les Cultures Coloniales' (Paris 1810s); B penters' Association, 'Tea in Ceylon' (Ceylon 1910); 'Tea and Coffee Trade' (Table of the Principal Kinds of Teas) (New York 1910); 'The Manufacture of Tea in the United States' (Washington 1912).

M. G. KAINS, Crop Expert.

Varieties of Tea. Teas were named after the place of origin, as tea-uuing all from that country, but more often a brownish-green leaf tea, well-picked. The qualities are indicated as long or well-curled, light-colored, etc. Tea is named mostly after the large trees; the varieties are termed pekoe souchongs, souchong, congou, leaf, etc.; the congou is black, the black inclining to red, the pekoe yellowish tips, while the red leaf is souchong. The hyson is a large-leaved tea; the hyson skin is the remnants of the leaves put in up hyson. Oolong is a yellow tea, and Twankay a green tea imperfectly rolled. Bohea is a standa peak tea, gathered three times a year from the variety largely advertised as breakfast is souchong, while imperial oolong is a long, yellow leaf, tight, Imperial teas are named in the trade as leaf, dust, ends, fannings, etc.

IN AMERICA. About 1880 the tea-a Department of Agriculture established a tea-growing plantation near Sum Cherry. S. C., and various varieties were an experimental way. Later the plan and the Pinhe Tea Gardens 1 the suburbs, being supplied with water from a tract of about 100 acres and tured and cured by competent people. experiments were made at a place of tea, in Colleton County, S. C., and Texas. While it was found possible to produce good teas and to cure them satisfac- tion on 100 acres and cured by competent people. experiments were made at a place of tea, in Colleton County, S. C., and Texas. While it was found possible to produce good teas and to cure them satisfac- tion on 100 acres and cured by competent people. experiments were made at a place of tea, in Colleton County, S. C., and Texas. While it was found possible to produce good teas and to cure them satisfac- tion on 100 acres and cured by competent people. experiments were made at a place of tea, in Colleton County, S. C., and Texas. While it was found possible to produce good teas and to cure them satisfac- tion on 100 acres and cured by competent people. experiments were made at a place of tea, in Colleton County, S. C., and Texas. While it was found possible to produce good teas and to cure them satisfac- tion on 100 acres and cured by competent people. experiments were made at a place of tea, in Colleton County, S. C., and Texas. While it was found possible to produce good teas and to cure them satisfac- tion on 100 acres and cured by competent people. experiments were made at a place of tea, in Colleton County, S. C., and Texas. While it was found possible to produce good teas and to cure them satisfac- tion on 100 acres and cured by competent people. experiments were made at a place of tea, in Colleton County, S. C., and Texas. While it was found possible to produce good teas and to cure them satisfac- tion on 100 acres and cured by competent people. experiments were made at a place of tea, in Colleton County, S. C., and Texas. While it was found possible to produce good teas and to cure them satisfac- tion on 100 acres and cured by competent people. experiments were made at a place of tea, in Colleton County, S. C., and Texas. While it was found possible to produce good teas and to cure them satisfac- tion on 100 acres and cured by competent people. experiments were made at a place of tea, in Colleton County, S. C., and Texas. While it was found possible to produce good teas and to cure them satisfac- tion on 100 acres and cured by competent people. experiments were made at a place of tea, in Colleton County, S. C., and Texas. While it was found possible to produce good teas and to cure them satisfac- tion on 100 acres and cured by competent people. experiments were made at a place of tea, in Colleton County, S. C., and Texas. While it was found possible to produce good teas and to cure them satisfac- tion on 100 acres and cured by competent people. experiments were made at a place of tea, in Colleton County, S. C., and Texas. While it was found possible to produce good teas and to cure them satisfac- tion on 100 acres and cured by competent people. experiments were made at a place of tea, in Colleton County, S. C., and Texas. While it was found possible to produce good teas and to cure them satisfac- tion on 100 acres and cured by competent people. experiments were made at a place of tea, in Colleton County, S. C., and Texas. While it was found possible to produce good teas and to cure them satisfac- tion on 100 acres and cured by competent people. experiments were made at a place of tea, in Colleton County, S. C.
the captain, Robert Maynard, slew Thatch in a hand-to-hand struggle. His career is one of the most romantic in the history of American piracy. "Blackbeard the Pirate" being considered the ideal type of the pirate of fiction. Consult his "Life" in Charles Johnson's "Lives of the Pirates." (1724).

TEACHERS, Professional Training of. Richard Muleaster of London advocated the professional training of teachers as early as 1561 and suggested that a teachers' college be organized as a department in a university. Nothing definite or permanent appears to have come from this suggestion. The first genuine effort for the professional training of teachers undertaken in the world was undoubtedly by Jean-Baptiste de La Salle at Rheims in 1681.

Three years later the institution which he founded at Rheims became known as the "Institute of the Brothers of the Christian Schools." He later established a similar school at Paris. In this school he organized a regular, systematic course of instruction for the preparation of teachers in the profession. In 1697 he selected certain poor students in attendance upon this school and organized them into a "teachers' class." The members of this class gave instruction to the other pupils in the orphans' school, and for this service Francke allowed them free tuition and board. Twelve years later Francke selected 12 students from the pupils in his orphan asylum to be trained as teachers. These students were devoted to "the study of the "their piety, knowledge, and aptness to teach." Francke called this institution a "Teachers' Seminary." Hecker -- a pupil of Francke -- has the honor of establishing the first regularly organized institution devoted to the special work of training teachers. This school was established at Pomerania, Prussia, in 1735, and Hecker gave to it the name used by Francke and called it a teachers' seminary. Hecker established a second school of this type at Berlin in 1748. Frederick the Great gave official endorsement to the effort to provide special training for those who were to be employed as teachers in the schools, by raising Hecker's school to the rank of a royal primary school for the purpose of training parish clerks and teachers. He gave this school further royal favor by directing that all parish clerks and all teachers appointed by the Crown should be selected from its students. Little progress was made in the establishment of institutions of this kind or in the training of teachers in Europe until after the French Revolution. At the beginning of the 19th century, the development of institutions to train teachers took on new life and the Prussian system of normal schools was firmly established. Six normal schools had been organized in that country.

It was about this time that the subject of preparing teachers for public schools began to receive attention in America. Men interested in educational reform began to consider this subject. The manner in which these men first approached the subject is not indicated that they were familiar with what had been done in Europe; a training of teachers or the establishment of normal schools was practically unknown.

The paper prepared by these men revealed a consciousness of the necessity of establishing adequate educational facilities in America and of preparing teachers to take charge of such schools as should be established. The papers written by these men indicate that these writers were speaking from the experiences and needs of the nation and not from historical knowledge of what had taken place in other countries. Among the numerous articles which appeared at this time and which exerted great influence in developing the idea that teachers should be professionally trained were the address of Denison Olmstead in 1810 on the "State of Education in Connecticut," the pamphlet issued in 1823 by William Russell, principal of the New Haven Academy, on the subject of "Suggestions on Education," the publication entitled "Lectures on School-keeping" issued in 1829 by Samuel R. Hall who founded a school for training teachers at Concord, Vt., in 1823, the articles published by James G. Carter in the Boston Patriot in the winter of 1824-25, the paper of Rev. Thomas H. Gallaudet in 1825, the pamphlet for the Education of the Instructors of Youth," the pamphlet of Walter R. Johnson of Germantown, Pa., issued in 1825, on "Observations of the Improvement of Seminaries of Learning in the United States, with suggestions for its Accomplishment," and many others. These articles gave to the public much valuable literature on the subject of education in general as well as upon the importance of special training for those who were to teach. The democracy of the nation was demanding and with this development came a demand for schools.

In the beginning of the 19th century 15 States either established systems of schools or reorganized existing systems. New York provided for State supervision of her schools in 1812 and 11 other States soon followed in making similar provision. The expansion, enlargement and improvement of educational facilities has always been coupled with a demand for better teachers.

The type of teachers employed in the schools in many cases was a potential product of a system of training teachers. The men employed as teachers in the academies and colleges were generally men of education and character. This was not true of the men employed in the primary schools. The primary school teachers possessed little education, had received, of course, no training and had no intention of remaining permanently in the teaching service. Men often sent their sons to Europe to be educated and sometimes imported teachers from Europe to instruct their sons. Many were unable to get other employment because of their lack of education or of proper character and often enlisted in the teaching ranks. But even in this demoralized situation, able young men who were either working their way through college or had completed their college courses and intended to enter either the professions of the law, medicine, or ministry, or business careers, taught a few terms or years. Among the many men who have long been known for their work in this field, many may be mentioned: John Adams, Eli Whitney, Daniel Webster, William Ellery Channing, William H. Seward, Salmon P. Chase, and, in later years, James G. Blaine and Elihu Root. As late as 1887 Horace Mann stated that, of the teachers employed in the State of Massachus-
side of the city of Boston, about 200 to devote themselves to teaching and others were not generally qualified and to show the year in which the they get to the end of the term than they were to give during the term.

men in public affairs in all parts of the city recognized this condition in educators and gave it consideration. The New City 1845, the teachers of New York City in an organization known as the "Society of Teachers." The purpose of this society was to promote the interests of its members generally. Members were the society by ballot, and a three-to-one vote was necessary to an election. The society did much of the work now performed by the professional supervisory staff of the system. It passed upon the qualifications of teachers, upon textbooks, upon the professional decorum of teachers and the pedagogical questions of that society.

It had been a voluntary organization until 1839 when it was incorporated by Act of the New York Legislature. The petition for incorporation carried in the New York City. The petition and the original society of 1794 were merged into the charter granted the organization in the following language, the objects of which are:

1. Relief and benefit of decayed teachers and their widows and children of deceased teachers, and for this purpose subjects and for the promotion of the interests of the members of the society.

The society immediately entered upon a for the intellectual improvement of its members and its official reports show that this work was carried on with great success for several years. The society gave special work to train and equip teachers to teach in New York. This society was undoubtedly the most successful institution of its kind in America which gave definite training to teachers for public schools.

Through the initiative and influence of Clarkin, the legislator of New York, a new organization was created called the "Society for establishing a school in the city of New York for the support of poor children as do not receive the benefit of the teaching services of the city schools." This society became known as the School Society of New York. It reported for 1814 contains the following:

the commencement of the society it has been the great interest to train up young men for the teachers in similar institutions. The realization of this is in part accomplished.

It is stated in his work on DeWitt that a youth educated in this school would become a teacher in a similar school in Norwich, N. Y., and that the society had an application from Newburgh, N. Y., her. The Free School Society adopted the master system of schools. The report of 1818 states that the society was doing a great deal of work, and specifically states that the teachers were not only provided for, but were also given specific directions as to what the society was doing to aid teachers and specifically states that those in the schools where they were properly trained.

The first organization endeavoring to train teachers for public schools. See article Lancaster Schools, Vol. 16, p. 687.

The official records do not indicate the precise year in which the school was founded. The school was founded in 1821, and the 1821 report contains the announcement that the societies were training teachers for the academies in New York State. The report of the Regents for 1821 contains the statement that the academies were training teachers for the common schools and the Regents expressed the opinion that the schools of the State must look to the academies for their supply of teachers. In the annual report of the Regents for 1823 the statement is made that because of the distribution of public funds under its direction to the academies subject to its supervision, such action "insures a supply of competent teachers for the common schools." New York was undoubtedly the first State which took specific action to solve the problem of providing trained teachers for the common schools. One of the vital questions in the establishment of agencies for the training of teachers was the manner in which the funds were to be raised in New York. This question was, Shall the state establish educational institutions to be utilized for this purpose or shall separate institutions devoted to such work be organized? The academies in New York were numerous, influential and under the control of the Regents. The friends of these institutions were zealous in their efforts to have the academies designated to train teachers. The State was giving their institutions financial support from the literature fund. The academies began to give special training to those who were going out to teach as early as 1821, and such instruction has been given continuously since that date. The friends of the academies endeavored to increase the amount of State aid to these institutions and based their argument upon the service which the academies were rendering the State in training teachers. They were successful in 1827 and not only succeeded in obtaining larger financial support but also obtained statutory recognition to train teachers without specifying how such service should be performed. The Regents, however, at once designated certain academies for this purpose and other academies continued to do such work voluntarily. The academies still pressed their interests at the legislature and in 1834 obtained the enactment of a law specifically authorizing the Regents to designate academies in which training classes should be organized. These training classes have been continued since that time and 80 were maintained in the year 1918-19. Through this agency about 25,000 teachers have been supplied to the rural schools of the State.

In 1823 Rev. Samuel Hall opened a school at Concord, Vt., for the training of teachers. He was sent to this town as a preacher by the Domestic Missionary Society of Vermont. He was asked to remain upon the distinct understanding that he should have no connection with any school for the training of teachers. He admitted to his school a class of young pupils for the purpose of having the opportunity of showing them the best methods of teaching and governing a school. The literature relative to this school shows that Mr. Hall had no
textbooks, periodical or other helps or equipment, and that he conducted the school on his own knowledge and judgment of educational methods on the basis of his experience in teaching. Growing out of his experience in this school he gave a series of lectures on 'school keeping.' There was a great demand for this work and the supply was soon exhausted. The State of New York purchased 10,000 copies of a revised issue. This was the first time this sort of help was afforded for such work in existing institutions. He had won a victory in the State of New York, the question was not permanently settled. The training of teachers was being considered in a broad, comprehensive manner by thoughtful educators, by State supervisory school officers, by the superintendents of schools, and in 1825 a strong presentation of the subject by Walter R. Johnson of Germantown, Pa., published in 1825 and of Rev. Thomas H. Gallaudet in the same year made a deep impression upon the public mind. He delivered a paper in the solution of the problem. Dr. Philip Lindsley in his inaugural address as president of Cumberland College, Nashville, Tenn., in 1825, stated that the teacher needed training for his work as much as a lawyer or doctor and urged the establishment of teachers' seminaries and in 1830 he appeared before the legislature of that State and advocated the establishment of such seminaries. In the same year Gov. DeWitt Clinton in his message to the legislature of New York also advocated the establishment of a seminary for teachers. In 1836 State Superintendent Spencer in a special report to the senate of New York also urged the plan of teachers' seminaries. Governor Lincoln of Massachusetts in his messages of 1826 and 1827 to the legislature of that State urged the importance of making provision for the training of teachers. The American Institute of Instruction petitioned the legislature of Massachusetts upon the same subject in 1827. Dr. George J. Barlow in a committee report of 1834-35, Chauncey Colton, president of Bristol College, in 1833 urged upon the legislature of Pennsylvania the establishment of courses in colleges for the training of teachers and that the common schools in the town should be used as practice departments. In December 1829, 37 citizens of Rochester, N. Y., called a public meeting in that city to consider the educational needs of the times. This committee prepared a report which was adopted by the meeting and among the recommendations was one for a State seminary to train teachers. A comprehensive plan was proposed for the administration of the seminary and for the course of study. This plan proposed "a farm of 100 to 200 acres, under the direction of an intelligent farmer, a nursery and a nurseryman and a mechanics shop with a general assortment of tools, such as the miscellaneous business of the farm and garden may require." In 1836, a public meeting of citizens in Philadelphia recommended the establishment of a teachers' seminary as an independent institution containing a three years' course of study and a model school. In the State Superintendent Burrowes of Pennsylvania recommended an appropriation of $5,000 for the establishment of a model school in the eastern part of the State and in the western part, for the training of teachers. In 1829 the 'Annals of Education' by Woodbridge published a translation of German periodicals giving an account of Prussian semi-naries for the training of teachers. Articles on and translations of C. Report on Public Instruction in Germany appeared between 1830 and 1835. These were published extensively in the newspapers of the country. It was out of all discussions and proposals that the school idea developed in America. Then two men in Massachusetts who rendered service in the successful effort to establ normal school. These men were Mr. C. Brooks and Mr. Freeman. Mr. Brooks made a careful study of the Prussian system of normal schools and in a Thanksgiving speech in 1835 at Hingham he explained that he prepared three lectures on the subject and he delivered them in a series of articles. He issued a circular inviting citizens of Ply mouth County to meet him to consider the subject. This invitation included every board of education of the county. A large audience met him at the courthouse. The address impressed Ichabod Morton that he offered to contribute $1,000 for the establishment of a normal school at Plymouth. Mr. Brooks traveled 2,000 miles, delivering addresses in the county and contributed a continuous series of articles on the subject to the newspapers. A number of representatives invited him to address them. He also addressed the legislature of Vermont, New Hampshire, Maine and New Jersey, and many cities and villages in States. Mr. Carter, who has often been the 'Father of Normal Schools,' had a comprehensive outline of his plan for the training of teachers in the articles which he wrote for the Boston Patriotic and other papers. He emphasized the essential elements in the work of a normal school. These were: (1) the development of sound scholarship; (2) a course of study in the science and art of education; (3) practical school. Nearly all the schools in these points are the vital features of normal schools of America. The people of the town of Lancaster, Mass., offered their very large sum of money for the establishment of a school in Lancaster. He later put obstacles in his way and the offer failed. In 1835 Mr. Carter was elected to the legislature, and in 1836 he was made a member of the committee on education. He was successful in getting the legislature to establish a seminary for the training of teachers, but failed in his efforts. He had succeeded in getting the bill providing for a State Board of Education, which became a law in 1837. He was a strong advocate of the establishment of normal schools. He obtained the assistance of the General Assembly to provide for the establishment of a seminary for the training of teachers. Edmund Dwight, a member of the legislature, was the drafter of the bill that was passed. He was a strong advocate of the establishment of normal schools.
establishment of institutions to train teachers, the State would appropriate an additional $10,000. Mr. Mann communicated this intention to the legislature 12 March 1838. On 12 March a joint committee, which had previously reported a resolution appropriating $10,000 to the State Board of Education for the training of teachers, but which was amended to increase the amount to $10,000, was given executive approval to spend $10,000 to the State Board of Education for the training of teachers, but it was subsequently reduced to $10,000. The establishment of these schools in Massachusetts and in New York did not prevent their enemies from opposing the continuation or development of such schools. Governor Dix of New York, who had been friendly to the academies for many years, was decidedly hostile to such schools in his message of 1874, and Governor Robinson, in his messages of 1877 and 1879, made a direct attack upon normal schools and stated that they were "wholly useless." In the same year the legislature authorized an investigation of such schools. In 1840 the house of representatives of Massachusetts directed the committee on education to consider the expediency of abolishing the State Board of Education and the State normal school. The majority of that committee prepared a report recommending that both should be abolished and presented a bill to carry out such recommendation. The measure failed to pass. It is in the face of such determined opposition that the plan outlined that the normal schools have arisen in America. The success of these schools in New York and of the Albany school made it possible to develop the system of normal schools now in existence in the United States. Others were gradually established. The New British school was organized in 1849, the Ypsilanti in 1852 and about 70 others prior to 1875. At the present time there are 237 public State normal schools, and before the war the number of students in attendance upon such institutions preparing to become teachers was nearly 100,000. There are also 45 private normal schools attended by nearly 6,000 pupils.

These schools are supported by State appropriations. In some States they are wholly under the supervision of the State educational authorities. In others they are only partially under such supervision and in some the State exercises practically no supervision or control over them at all. The age of admission is usually 16 years. The courses of study are generally either two years or four years, depending upon the qualifications of the students when they enter. In some schools, as those of New York, the requirements for admission are graduation from a four-years' approved high school course. In such normal schools the course is two years and is devoted to professional work. In many schools a student is admitted from the elementary schools and for such students the course is generally four years. When normal schools were first organized, their courses of study included much academic instruction. The development of high schools throughout the country has resulted in decreasing the academic work in normal schools and in increasing the professional work. The present tendency is to lengthen the courses so as to cover three or four years. In New York the Board of Regents has recently authorized three-year courses in all the normal schools of that State. In many of these schools special courses, such as kindergarten, drawing, music, manual training, home making, rural school and other courses are given. Practice departments or
model schools are maintained in all the normal schools and in many of the normal schools use the public schools for practice departments. These schools generally train teachers for the elementary schools, although some prepare teachers for secondary schools also. Some of the normal schools give extension courses on Saturday and during vacation periods and some take their students into the rural schools for practice work and for demonstration.

The State College for Teachers at Albany prepares teachers for secondary schools only. The courses cover a period of four years, and the admission requirements are the completion of a four-years' approved high school course. The work in this institution is of collegiate grade and degrees are conferred upon those who complete prescribed courses. There are 800 students in this institution preparing to teach in the high schools of the State.

The Education Law in New York has required since 1875 that all teachers employed in the city and in the villages having a population of 5,000 or more shall have graduated from a four-years' high school course and thereafter from a two-years' professional course (Chapter 1031, Laws of 1895). In most cities, and in the villages, the same requirement is prescribed. Normal schools are unable to meet the demand for teachers and many cities have organized city training or city normal schools. These schools generally maintain entrance requirements and courses of study equivalent to those of the normal schools. These schools prepare teachers for the kindergarten and the elementary schools. New York maintains three of these schools, Philadelphia, two, and a school of this type is maintained in Albany, Buffalo, Rochester, Syracuse, Schenectady, Yonkers, Boston, Pittsburgh, Cincinnati and in most of the large cities of the country.

Within the last 25 years there has been a demand in all parts of the country for better trained teachers in the rural schools. About one-third of the teachers employed in these schools have had no training whatever. This demand has resulted in the establishment of numerous types in about one-half of the States for training teachers for rural schools. In New York the training classes maintained in high schools have supplied these teachers for years. Missouri, Vermont and several other States have organized similar classes in their high schools for training rural school teachers. In Michigan, county normal training classes have been organized, but these do not differ materially from the training classes in these other States. Wisconsin has organized not only this type of training class in her high schools, but she has also organized county training schools. These county training schools are in no way connected with other schools, but are generally maintained in separate buildings and have an independent organization. The requirements for admission to these classes vary. In New York it is high school graduation. In most States it is the completion of two years' high school work. In Pennsylvania the last year of the high school course is devoted to teacher training. In other States students are admitted from the elementary schools. The course of study usually covers one year and the age of admission is from 16 to 17 years. Many of the State normal schools maintain special courses for rural teachers.

Several efforts were made to establish chairs of pedagogy or colleges of education in the universities which would take rank with the department of law, medicine or engineering. New York University established a school of the philosophy of education for educating teachers of common schools in 1832. Thomas H. Gallaudet occupied this chair from 1832 to 1834. It seems to have been abandoned at that time. Brown University established a similar course in 1850, but discontinued it in 1855. Horace Mann included as an elective study in the regular course of Antioch College, Ohio, in 1853 the theory and practice of teaching. From 1853 to 1873 Iowa University offered courses for teachers and in 1878 opened its college of normal instruction.

On the recommendation President Angell, Michigan University established in 1879 a chair of the science and art of teaching for the following purposes: To fit university students for the higher positions in the public school service; to promote educational science; to teach the history of education and of educational doctrine; to secure to teaching the rights and privileges of a profession, and to give a more perfect unity to the State educational system by bringing the secondary schools into closer relation with the university. A plan was proposed for giving instruction in the science and art of teaching in the University in 1838, but was not carried out at that time. In 1880 the college opened certain courses for training teachers and in 1888 Teachers' College was founded and in 1889 chartered. Doctor Nicholas Murray Butler, now president of Columbia University, was the first head of this new institution and as president of Columbia is now president of Teachers' College. This college is one of the notable institutions of the world. It trains teachers, superintendents, directors and superintendents for all the higher technical and professional positions in the teaching and supervisory staffs of the city and State school systems of the country. Several thousand students are annually enrolled in this institution. All of the teachers of the country now maintain departments of education or colleges which are rapidly taking rank with the departments or colleges of law, medicine and engineering and are meeting the demand for specialists which the developing public educational systems of the country require.

Summer schools have become a strong and influential factor in the training of teachers. Harvard University was one of the pioneer institutions in America to give summer courses. Harvard has given such courses for 48 years. Martha's Vineyard Summer Institute, organized at Cottage City, Mass., in 1878 by Col. Homer Sprague, has been one of the notable institutions of this type. It was closed in 1905. In 1879 the Sunday School Assembly at Chautauqua, N. Y., organized a summer course of psychology and pedagogy which soon became an important course. In 1896 the number of teachers was increased and the summer sessions were held at Chautauqua give several courses for teachers. After these and some other institutions had been successful in holding summer sessions, the work was rapidly taken up by
schools, colleges and universities, and of several important institutions at the college level. About 800 schools were held in 1919 and the attendance was approximately 300,000. Columbia University established three institutes in 1837. Mr. Stephen Sweet opened a temporary school for the training of teachers in 1842. Mr. Sweet contemplated opening a permanent school in the winter of 1843. The work which he did in the winter school is quite similar to that as later done in teachers' institutes. Schools organized by Mr. Sweet became generally as temporary schools for teachers, or temporary normal schools. Because of this, he was able to train teachers in various parts of the country which had been organized in New York.

In 1843 Dr. Henry Barnard of Connecticut was one of the early leaders in the field of education. He opened a school at Ithaca and was organized as the superintendent of schools. The fame of this institute spread throughout the country. Within three years, 2000 teachers were trained in Massachusetts, Ohio, Rhode Island, Indiana, New Hampshire and Vermont. It is clear that New York and Pennsylvania were the centers of the system of institutes organized in other States. Institutes were established in New York State in 1812, and conferences under the direction of superintendents were substituted there. These conferences were held in many States. In Arkansas and Ohio they were an important part of the teacher training process. They were managed and generally formed the resident of the supervisory district. Schools are closed for the purpose of conferences on the promotion of the arts of art in relation to school management, and other school work, and the general good of all the schools of the district. Appropriations are made in some instances by the State and in others by the county to meet expenses paid by teachers. Attendance is usually compulsory. The method of instruction is generally the lecture system. These lectures are on subject matter, school discipline, school organization, school management, methods of instruction popular and inspirational themes. In some instances they depart from the primary purposes of an institute which is to improve the teaching force and the form of community centers. In such cases they have become mass meetings instead of classrooms for instruction.

In 1895 the Paulist Fathers in New York organized an institute for the general improvement of the teachers in Catholic schools. It is called the National Catholic Teachers' Institute, and under the general management of this organization provision is made for the maintenance of local institutes in various parts of the country for the benefit of the teaching orders connected with Catholic schools.

Teachers' reading circles have exerted a strong influence in developing a professional spirit among the teaching fraternity. The first circle was probably organized in Ohio in 1832 upon the suggestion of Dr. L. L. Williams, a teacher in that State. The circle was formulated somewhat upon the plan of the Chautauqua literary course. Many of the other States of the Central West and West have organized similar circles. There are now several national and state organizations of the State Teachers' Association or the State Education Department. In some States the circle is under the joint management of such authorities. A definite course of reading is prescribed, textbooks suggested and examinations prescribed. Many States give some credit in their plan of certification to those who have done successful work in the circle. In 1915 the National Rural Teachers' Reading Circle was organized under the direction of the Bureau of Education at Washington.

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TEACHERS' COLLEGE—TEACHING METHODS AND SYSTEMS


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TEACHERS' COLLEGE, a school for the training of teachers, affiliated with Columbia University. For several years the college has maintained courses for teachers in New York schools, and since 1897 has made these courses an integral part of the regular college courses. The continual increase in the number of teachers taking these courses led to the organization of an extension department in 1901 which includes the entire university system. The university accepts courses in education as part of the requirement for the degrees of A.B., A.M, and Ph.D. The college diploma is conferred upon students who have successfully completed some of the general courses, and a departmental diploma upon those who have fitted themselves for particular branches of school work. Undergraduate students of Columbia and Barnard colleges may obtain the diploma of Teachers' College when they receive the degree of bachelor of arts.

These are the undergraduate courses: Secondary course leading to the degree of A.B., and the college diploma; general course leading to the college diploma in elementary teaching; general course leading to the college diploma in kindergarten teaching. Then there are several courses leading to the college diploma in art, domestic art, domestic science and manual training. Candidates for the first of these courses must be either college graduates or candidates for the degree of A.B., in Columbia University. There is a combined course of study prescribed for the degree of A.B., in Columbia University and the diploma of Teachers' College.

TEACHERS' EMPLOYMENT AGENCIES. Teachers' employment agencies are of two classes, viz: (1) Those that carry on the work in a commercial way and collect fees from teachers for the service rendered in obtaining positions; (2) those managed by institutions of learning, as colleges and normal schools, that obtain positions for their own students or graduates without payment other than general tuition fees. Commercial agencies have existed since 1855 but did not become a prominent factor in the employment of teachers prior to 1890. At the present time there are agencies in most of the prominent cities of the country, some doing a local business, others being national in the scope of their activity. The methods employed by all commercial agencies are quite similar. A teacher enrolls by paying the required fee; making a written statement of his age, education, experience and references. The agent on receipt of the statement writes to the references for further data. When a call for a teacher is received by the agency, two or three of the enrolled teachers best qualified for the place are made application, and the strongest is usually recommended by the agency. The agency's candidate is employed and usually pays the agency a fee of 1/3 of the first year's salary. A well-trained agency becomes an important factor in teachers in the positions for which best qualified. Probably the most service rendered by agencies, however, proper placing of teachers with special qualifications.

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TEACHERS' INSTITUTES. See PROFESSIONAL TRAINING OF.

TEACHING METHODS AND SYSTEMS. Teaching, or the imparting of knowledge by the means of lessons or examples, is a matter of study, evidence, acceptance or rejection of methods through the entire history of education. Talleyrand said that methods of masters of teachers—les méthodes des maîtres. The present educational workers is to make methods to instruction. Two general basic sciences are important in the acquisition of knowledge. The inductive lesson is used in the classroom where associations are made, classes, groups or families of things are classified in use, structure and appearance. A child easily gains a concept of a chair shown a piece of simple furniture with legs, a seat and a back. He may process of time that various articles are constructed, wood, grass, wire, different shapes have been evolved broad, deep—buts strictly, even Toledo is a class. On the hand, a thing that cannot be understood, he cannot classify, is useless. "When a general idea or principle, applies to several or all of the same, so as to explain or give them meaning, is obtained through the study of concrete, individual instances, the process is inductive." Deduction is the opposite: instead of forming one's own conclusions from a series of facts, the student employs those principles already received by his own experience or that of others. The teacher employs the method when he asks pupils to answer questions, to divide problems, to master a subject by referring to rules, laws and axioms. He uses it when he reduces a fraction to its lowest terms: by applying the rule the fraction may be reduced to its lowest terms by dividing both numerator and denominator by their common factors until no common factors remain. In the process of deducing which may not always reach a definite conclusion. Different ones may be tried, some are useful, tried, rejected. "Guiding principle sometimes they are found.

The specific methods of the divide them into three: testing, drilling, teaching. The knowledge provides the instruction point, showing the achievement of the test and its progress, giving oppo
TEACHING OF THE TWELVE APOSTLES

The question and answer method is employed in aiding students to formulate their questions, to aid them in expressing to the best of their judgment, and to form correct conclusions.

This method is being introduced with test success in language teaching, where practice is essential if the pupil is to acquire more than a mere bowing acquaintance with the language under study. Its answers are planned so that the speaker says very little and the pupils a great deal. The question should be correct in form, in meaning, framed in simple terms, comprehended and adapted to the knowledge of the pupil, stimulating to the thought, addressed to the class, and framed so as to draw forth a complete expression.

The question and answer method should lead naturally into the topical method which encourages pupils in freedom of expression and gives opportunity as strength comes to discuss topics and make reports on assigned subjects calling for mastery of the subject and independence of thought. This develops skill in organization of ideas, provides powers of expression and furnishes practice in alertness, systematic thinking, and establishes confidence in one's self. This method can be successfully used in the development of all new topics where the new matter is to be connected to the old in the mind of the learner. It may be a half-formed conversation between teacher and class, directed by the teacher and commanding such full and free expression as will fulfill the mastery and development of the topic.

Lesson plans carefully considered and clearly formulated are of great practical value. In the daily plan the teacher considers the subject matter of the review and advance lesson and the class procedure. The daily plan finds its place in the term scheme and the term scheme is a unit of the syllabus for the year. This daily planning prevents a haphazard course and provides for regular orderly progress. A well-organized plan involves a definite aim, bringing to the aid the proper method, which economizes time and effort.

Results obtained by supervised study have become so successful that a brief survey of this method should arouse the interest of school men in such a way as to lead to its wide adoption. By means of it the teacher is enabled to present the subject matter in such a clear, concise way that every pupil is afforded an adequate opportunity to understand and to master the various daily problems of the subject. It is an elaborate and complete assignment of the next lesson, made so clear that the details present themselves so plainly and logically that all have a maximum opportunity to learn the lesson. It has the advantage of giving aid when aid is most needed, of economizing time and effort and forming correct habits of attack and application of principles.

With the modern trend of social conditions in the city, crowded part time and frequent abundant attraction, some method and supervision should reach into the home to grip parent and student alike. Frequent reports of progress should go to parents; specific direction given in study; students held to the definite performance of certain tasks and an effort made to train in such economy of time and effort as to make school work a delight. This can be accomplished by carefully scheduled program at home and at school.

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TEACHING OF THE TWELVE APOSTLES, a part of the Apostolic Constitutions (q.v.) enunciating principles of Christian faith and practice. It was first (1873) discovered by Bryniumus, metropolitan of Nicomedia, in a manuscript of the 11th century and was published in 1875; since which it has been the oc-
TEAK—TECHE BAYOU

easion of much discussion. Consult Harnack, ‘Texte und Untersuchungen zur Alchistlichen Literatur’ (1885). Shad first cut, but when aged, darkens to the tint of black walnut. It is very durable, examples in house-timbers having already survived for hundreds of years, is straight in grain and easily worked. It takes a high polish and if properly seasoned will not warp or split. Teak is used for house-building, furniture and wood-carving and is one of the most valuable woods for shipbuilding, especially for deckings and for backing the metal plates of iron-clads, since it contains a resinous oil, which prevents it from corroding iron; it is also in demand for car-wheels, gun-carriages, railway ties and engineering works. Although the natural supply of teak, throughout its range was great, as it occurred in mixed forests, most luxuriantly in Burma and adjacent regions, it was rapidly disappearing on account of the unceasing demand and lack of replanting. Great Britain has checked this waste by efficient protection and forest-administration in its Indian and Burmese dominions. The timber is mostly consumed in India. The tree is not usually found in pure forests, but mixed with bamboo, which it overtops and which seems necessary for its growth. It requires a light soil with good sub-drainage. The leaves, which are nearly 10 inches long and resemble those of the tobacco, are somewhat drooping and coriaceous and appear as soon as the rainy season opens. They yield a red dye. Teak trees may easily be distinguished for some time during the rains by their broad terminal panicles of flowers, which are small, white and fragrant, on slender branchlets. The seeds are oily, in a hard nut covered with a felt of matted hairs and further enclosed in an enlarged membranous calyx. These feathery panicles render the tree again conspicuous during the dry season, when it is leafless. The seeds are plentiful and would soon restore the forests, were it not for the forest-stores, raging just about the time when the nuts are falling. Many of the seeds, however, are washed down by the first heavy rains of the monsoon, into the valleys, where the trees are principally found. Although many lots of teak have cracks or fissures running up through the centre from the butt, that are partly caused by the fire, the market value of the logs is greatly diminished; that of any other wood except mahogany, depends upon the regular cylindrical shape of the log. This should be in turns of 12 in 1 2 in to or other inequalities, but are taken in the plantation to the butt at about 1 2 in in the trunks. Teak trees may be as much as in 100 ft. tall and a diameter of 12 ft. to attain natural growth and 30 years for hardwood. The timber is exported by the houseboat from the mouths of the rivers. The season is from April to June, as the water rises, and the nut trees.

TEAL, a small fresh-water wild duck of the genus *Querquedula*. Netton, or some close related genus, many species of which occur in various parts of the world. The three North American species are the blue-winged (*Q. caerulescens*), the cinnamon (*Q. q. virescens*) and the common green-winged (*Netton carolinensis*). The former and last are of common occurrence all over North America. The males are noted for their brilliant red plumage, as compared with the sober dress of the little females; hence almost any small gaudy duck is likely to be called a teal in books of unscientific sportsmen and travelers.

TEARS. See EYE.

TEARS OF SAINT LAWRENCE. See SHOOTING STARS.

TEASDALE, Sara (Mrs. F. B. Finlay). American poetess. b. Saint Louis, Mo., 8, 1884. She received her education at pri schools in Saint Louis and spent several years in European travel. Her published works are marked by a charming lyric quality and a rhythmic feeling, include ‘Sonnets to Have and Other Poems’ (1907); ‘Helen of Troy and Other Poems’ (1911); ‘River to the Sea’ (1915); ‘Love Songs’ (1917).

TEASEL, any member of the genus *Dipsacus*, botanically not far removed from the campanulaceae. They are tall plants, often up to 6 ft. tall, with prickly herbs, the most important species being *D. fullonum*, a stout annual, with sessile, lanceolate to pinnatifid leaves, which are opposite and often cuneate. The large head of tubular flowers are gathered in dense terminal, oblong heads, subtended by an involucre and many-fractured. The flower is a few at a time, in horizontal rows. Both bracts and involucre are rigid and tough with spines, the latter being hook-shaped and denoting in fruit. They are then brown and thickly set, radiating from every side of the head, becoming cylindrical and very for raising the nap upon woolen cloth. They are fixed in circular heads on flat cards. The flowers are spiny, and are distributed in a variety of wild, *D. supinum*, which differs chiefly in having a broad, spreading, which are straight.

TECHE (tej) BAYOU, in the southern part of Louisiana, a small tide-water chan-
of Grand Lake, which flows generally by east into Atchafalaya Bay. It was the outlet or the main channel, by which the red river drained into the south of Mexico. The land through which the Teche now flows has been formed from silt brought down by the rivers and by the Mississippi. It contains some of the richest soil of the State. On it are raised large quanti- ties of corn, rice, sugar cane, and cotton. It is navigable to Saint Martinsville, about 100 miles above that point for small boats, and is high water.

CHNICAL EDUCATION. See EDU-

CHNOLoGY, Schools of. Schools of engineering in the United States are of comparatively recent date. The earliest was the Rensse-1 Polytechnic Institute of Troy, N. Y., founded in 1824; then followed the Husseit Training School in Technology, Boston; 1821; the Worcester Polytechnic Institute, Orcester, Mass., 1808; Lehigh University, Stevens Institute of Technology, 1871; Case School of Applied Science, in Cleveland, Ohio. From that time on the number of technical schools has rapidly increased. In 1900 there were 43 technical schools in the United States classified as of the technology by the Commissioner of Education. Among these are privately-endowed institutions, like the Stevens Institute of Technology; State institutions, like the Sit- college of Cornell University; scientific- nents of older universities and schools nents, like the Pratt and the Armour es. The technical schools in Germany are divided as (1) elementary industrial (2) secondary industrial schools; (3) polytechnic institutes. The tendency in the United States is along the same lines, pro- duce and less technical training, in con- with universities, colleges and schools with existing. Many of the State colleges ording in one institution the whole range of applied science. The requirements for admission to the technical schools in the United States are algebra, plane geometry, English literature, the history of the States, French and a knowledge of the n English branches. Some schools re- sult geometry, plane trigonometry, ele- y physics and chemistry and some re- sult in addition to the above. The gen- courses of study pursued are civil engi- mechanical engineering, electrical en- railway engineering, mining engi- chemical engineering, sanitary engineer- architect, pharmacy and chemistry. The of each course is usually four years. engineering forms an additional course University of Maine, University of Michi- one course in the United States. Schools of forestry are connected with the Cornell, and Syracuse University the University of Nebraska and the State University. Horticulture is taught at University, Ohio State University, Iowa State College, University of Nebraska, etc. Domestic art, domestic science, and the fine arts, in addition to steam and machine design and applied electricity, are given at the Armour Institute, Brooklyn, N. Y. At the Armour Institute, Chicago Ill., typewriting, music and domestic art are added to the usual engineering courses. The universities and colleges of the United States have added technological courses to their systems of instruction that it is no longer possible to separate the technological schools. The United States Commissioner of Education has ceased to classify them separately and only a few are known as distinctly polytechnic institutions.

Schools of Agriculture and Mechanic Arts.—The pioneers of technical education in the United States were privately endowed schools of technology, but technical education received its greatest impulse by the "Land Grant Act* and "Morrill Bill* of Congress from the year 1862 to 1890. (See COLLEGES, LAND GRANTS). Under these acts the Federal government has given more than 13,000,000 acres of public lands for the establishment and maintenance of colleges of agriculture and mechanic arts. The name has not always been retained as acts of State legislatures and private benefactions and other causes have led to a change or to an affiliation with State in- stitutions. But as a result, at least one such institution has been established and is now in operation in each State and Territory of the United States, except Alaska. The Interna- tional Typographical Union has established a large school of typography at Indianapolis and the International Printing Pressmen and As- sistant's Union, a school of presswork, near Rogersville, Tenn. Other trade unions are initiating the method and in this way many very important trade schools are developing. Of the institutions that have been organized under these acts, 51 are colleges of agriculture and mechanic arts, having in 1917 over 5,000 instructors; 54,391 white men students; 14,460 white women students, and 4,405 colored men and 6,208 colored women students. Separate institutions for colored students have been established in most southern States. The courses of study pursued in these schools are agriculture, all the branches of engineering, textile engineering (in North Carolina and Mississippi); forestry (in Michigan), and horticulture (in Washington and Virginia). Clem- son Agricultural College, in South Carolina, has a full equipment of cotton machinery for illustrating the manufacture of yarn and woven fabrics. Requirements for entrance differ very greatly in different States. (For detailed information regarding technical education in the United States, see EDUCATION, ENGINEERING; MANUAL TRAINING; TECHNOLOGY; TRADE SCHOOLS). Consult also 'Annual Report of the United States Commissioner of Education'; 'Report of the United States Commissioner of Labor on Trade and Technical Education'; 'Annual Reports of the Society of Mechanical Engineers.'

TECTONIC GEOLoGY. See GEOLoGY —

TECTUMSEH, tē-küm'sē, Shawnee chief: h. near Springfield, Ohio, about 1768; d. 5 Oct.
1813. About 1805 he formed the design of uniting the tribes of western Indians against the whites. He claimed that the land-treaties between individual tribes and the settlers were void, inasmuch as the land was the common property of all the tribes and could not be alienated by any one of them without the consent of the others. The British agents denied his dissatisfactions, which were increased by the ejection of Indians by settlers. Gen. W. H. Harrison (q.v.) warned him to desist, and concluded with a parley with him without result near Vincennes, Ind. He was aided in his plans by a brother, Tenskwatawa, who was reverenced by the Indians as a prophet. Tenskwatawa directed the attack at Tippecanoe (q.v.) Nov. 4, 1811, though he remained on a hill during its progress. Tecumseh was not present. He invited the Creeks in their futile revolt, joined the British, was made a brigadier-general, led 2000 Indians at the siege of Fort Meigs, commanded the right wing at the Thames and was killed there. He possessed great qualities of leadership. Consult Drake, "Life of Tecumseh."

TECUMSEH, Mich., village in Lenawee County, on the Kaisn River and on the Lake Shore and Michigan Southern and the Chicago, Jackson and Missouri railroads, about 35 miles northwest of Toledo and nine miles northeast of Adrian. It is in an agricultural region noted for its fruit, especially peaches. The chief manufactures are flour, furniture, wagons, carriages, brick, tile, paper, lumber, foundry and machine-shop products and dairy products. It has a high school, graded schools and a public library. The two State banks have a combined capital of $70,000. Pop. about 2,332.

TECUMSEH, Neb., county-seat of Johnson County, on the Big Nemaha River and on the Burlington and Missouri River Railroad, about 45 miles southeast of Lincoln and 60 miles south of Omaha. It is in a rich agricultural region. It is the commercial centre of a large portion of the county; the chief shipments are grain, livestock, vegetables and fruit. There are churches, a high school, four public school buildings and a public library. There are two banks, a national and a State, with a combined capital of $100,000. Pop. 1,748.

TEES, tész, a river in northern England, which rises east of Cross Fell forming along its entire course the boundary between Durham and the North Riding of Yorkshire, passes between Barnard Castle, becomes navigable between Delph and Yarm, and, after flowing a distance of 70 miles, empties into the North Sea at Middlesbrough, forming the Tees Bay.

TEETH, hard structures developed in the mouth and adjacent parts of vertebrated animals and concerned in the obtaining and mastica-
tion of food and secondarily in a variety of other functions. "They present," says Owen, "many varieties as to number, size, form, structure, position and mode of attachment, but are principally adapted for seizing, tearing, dividing, pounding or grinding the food. In some species they are modified to serve as formidable weapons of offense and defense: in others, as aids in locomotion, means of anchorage, instrument of or cutting down wires or for transporting and working of building materials. They are characteristic of age and sex; man they have secondary relations, subs to beauty and to speech. Teeth are always related to the food and habits animal and are, therefore, highly interest the physiologist, too, for the reason, important guides to the natural classification of animals." For further mention as to the development of the forms of teeth in relation to use, see TOOTH.

Teeth are a production of skin, and gous with the scales of fishes, and various hardenings of the surface; in some of the lower invertebrates there is angradation from one to the other. In an class, the birds (q.v.), they are now absent, their functions being performed by the covering of the jaws (bill) or by a beak, or both; but in the earliest extant they were present in both jaws and had resemblance to those of reptiles. Turtle and many amphibians are toothless; some of the inferior mammals teeth are only as embrionic rudiments, which did not assert themselves before or soon after birth. Many small hardened structures in the worms, echinoderms, mollusks, insects and other invertebrates, which are more or less concerned in biting, are popularly spoken of as teeth, but, strictly speaking, should be otherwise designated. In the present article will treat of the teeth found in the mouth of man and the vertebrates, where they arise from the covering of the jaw-bones, each root socket or sockets of its own formed by the maxillary bone.

Structure of Teeth. A tooth begins in embryonic life, by the development of the mucous membrane of the gum of a modified epithelial cells which dip into the substance of the gum and form the germ of the tooth, which will furnish enamel needed. Below that there next a mass of special tissue which takes the form of the future tooth. In due time it becomes calcified upon the surface, and this process ceases, downward and inward, until all substance of the papilla has been chiseled away, and the dentine remains filled with growing tissue (pulp) with blood and nerves. This is the principal constituent of the greater part of a tooth, and is seen to best advantage in the massive ivory of the tusks of the elephant, and consists of an organic and impregnated with mineral (chiefly phosphate of lime) disposed in the form of minute hexagonal columns, perpendicular to the plane of the surface of the crown receives the on the opposing tooth, and are horizontal in the opposite tooth, and are the pressure of the teeth. The roots also receive their support from the remains of the pulp, which circulates by anatomical
TEETH

which in mammals never normally occurs before birth. This appearance in some, as the seals, may take place all at once; but in most cases occurs at intervals, the front teeth usually showing before the back ones, which sometimes are not cut (for example, the "wisdom teeth" in man) until several years later. In man and higher mammals two sets of teeth are developed: the early, milk, or deciduous teeth, and the permanent set. Such forms are, therefore, named diphyodont; while those in which one set only is developed are named monophyodont. When more than one set occurs, those of the second are developed in precisely the same place and manner as the first, except as to certain details of the enamel germs. The milk or temporary teeth are gradually displaced from below by the upward growth of the permanent teeth, the fangs of the milk teeth being absorbed, and the latter falling out as their successors are more fully developed. This arrangement is adaptive to the growth of the animal's jaws, among other advantages. The milk-set in man consists of twenty teeth the tooth-sac, the inner layer of the diente, like bone, the crura cement, on the external surface of the tooth.

It is often found only as a thin surface of the root, which develops as the tooth grows, forcing the tooth root and above the gum; but some the molar teeth of the horse, ele- masteodon, is a structure which is important part covering and filling eristines between the folds of the dentine like true bone in general. Meanwhile the epithelial cells of the layer of the skin over the tooth-depositing upon the diente of the of the tooth, which is to be exposed, eyn hard bluish white, translucent, layer, composed of about 96 per neral matter, called the enamel, and resist the wear to which teeth are in their work. It is the hardest known substance of any animal form, but reducible to the simplicity of the simpler and milk teeth, or exposed part of the crown, is of the conical form and persistent, and continues to line the base of the tooth, which throughout life to compensate for away at the tip. These teeth are "rootless." The other type, ex- man, is called "rooted," and in this the "crowns," or exposed part of the been fully formed, the pulp within part that just beneath the sur- e gum, begins to fill with dentine, its downward growing pointed mass, or "fang," which at last is solid ex- ward as a cone protruding from the remainder of the pulp persists, ap- with nervous filaments from the cranial nerves. Various intermedi- between these two types exist. One type is of a chisel-like shape, to many chisel-like or massive iated forms, all of which are den the germ, and before the tooth appearance above the gum or is "cut,"

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the crown is crossed by parallel ridges, which are greatly varied and complicated, up to the huge molars of the elephant family; in these cases the ridges are formed by partition-like infoldings of the enamel and the interspaces are filled with cement. Such a tooth wears away at the surface, the different density of the layers of the substances of which it is composed—enamel, cement, and dentine—causes them to wear unequally, the hard enamel ridges projecting beyond the others and thus, as Flower says, "giving rise to a grinding surface of great mechanical advantage." The pattern of these ridges is characteristic of species; and by the changes of pattern which occur as they wear down, the age of the animal may often be closely estimated, a fact constantly utilized in the case of horses. This infolding of the enamel reached its highest complication in the curious "labyrinthodont" teeth of the ancient stegocephalian reptiles.

The dentition of any animal is expressed by a dental formula. That of man runs thus:

\[ 2-2 \quad 1-1 \quad 2-2 \quad 3-3 \]

This means that the incisors (1.) number two on each side of each jaw—the numbers above the sub-buccal line corresponding to the teeth in the upper jaw, those below the line indicating those of the lower jaw; while the further subdivision of the teeth above and below the line is meant to indicate the numbers in each side of each jaw respectively. The other signs and numerals, therefore, read that the canines (C.), premolars (P.M.) and molars (M.) number two, four and six in each jaw; making a total of 32 teeth. Similarly the dental formula of a ruminant (r.v.) such as the sheep would run thus:

\[ 0-0 \quad 0-0 \quad 3-3 \quad 3-3 \]

It is presumed by this notation that each tooth has its strict homologue, in all kinds of mammals at least; and if any are missing their character or name may be accurately defined. This theory encounters difficulties, for example, in comparing the dentition of marsupials with the higher mammals; but it serves conveniently in the description of ordinary animals.

Among the lower vertebrates teeth appear in great variety, as to number, form and functional modification. Those of fishes and fish-eating animals as the dolphins, are simple sharp curved cones, useful in seizing and holding their slippery prey, which is usually swallowed whole. In fishes and most reptiles the teeth are usually attached by ligaments, and shed and renewed, not once only, as in mammals, but frequently during the whole course of their lives. In sharks the teeth are placed in a common groove, and row after row may be developed; as in evolutions, fishes as the front and older teeth are worn away or detached. Fishes and amphibians may have teeth in two rows in each jaw, and also on the back part of the mouth and on the skull. In the ruminants we have the "sheep teeth," pharyngeal bones, soles of the mouth and in other situations. The lower vertebrates have the teeth acted on in various ways by the jaws, and are implanted in sockets as in man. In reptiles, as a general rule, the base of the tooth is anchoylosed to the bone which support it. The completion of a tooth is soon followed by preparation for its removal and successive faculty of developing new teeth germs apparently unlimited in this class. The teeth of crocodiles grow continually, on growing inside the pulp cavity of the tooth, displacing it. In many lizards teeth are anchoylosed to the summit of the jaw (acodont), or to the outer side of the pleurodont. Repartition teeth sometimes undergo great modifications, as in the poison fangs of vipers and rattlesnakes. Extraordinary modifications among men are seen in the horn pyphos-teeth of the bill; the entire absence of teeth of some states; the transitory teeth of the balenin; succeeded by whalebone; the "horn" of whal, the tusks of the elephant, walrus, boar, etc., each in relation to peculiar.

There is also a close connection between articulation or joint of the lower jaw as nature of the food used by the animal, in purely carnivorous animals, in which teeth simply tear and cut the food, no grinding is required, and the jaw is capable of a simple hinge-motion; while in herbivorous animals the joint is constructed to allow of extensive side to lateral motion of the lower molar teeth the upper. In man both the form of this joint and the general character of the point to an intermediate position in relation to the food, and form a physiological argument for the mixed diet which general customs have decided to be most natural to our species.

Diseases of the Teeth.—Decay (car) by far the most common of the diseases which affect the teeth, and consist in a gradual progressive disintegration of the tooth substance. Among the chief predisposing causes are hereditary defects of quality, imperfect calcification; pits and grooves in the gum produce a overcrowding of the teeth, facilitating introduction of particles of food between them, and thus causing disorders affecting the digestive system. Decay is usually caused by lactic acid generated in the mouth by the fermentation due to micro-organisms. Decay usually begins in a groove in the enamel or between the carious points forming a lodgment for the development of the organisms. Once the enamel becomes penetrated the decay proceeds more or less spreading laterally beneath the enamel and toward the pulp. The more the structure of the tooth the more does the decay penetrate in the direct of the pulp, though its process is not such its tendency to spread is less. Caries is common in early life, by far the great number of cavities making their appearance between the ages of 6 and 18. The treatment can only be undertaken by the and varies with the extent and character of the disease.

Periostitis and Alveolar Abscess is an inflammation of the periostum which covers the roots of the teeth and lines their sockets. By far the common cause is the presence of a
ous products of which cause violent
ion at the end of the root. When
osis has fairly set in, and its usual
iment, alveolar abscess, are perhaps
painful affections to which the teeth
ar abscess may be defined as a sup-
around the root or roots of a tooth. 
are those of periostitis which pre-
thashop the cavity nature in indicating the formation of mat-
in the surrounding bone. The face,
glands about the neck, swell, and the
hibit tenderness on touch. The dent-
ces its way through the bone to reach
ge of the gum at the point of least re-
which is most often opposite the end
it or roots (this is popularly known as
il). With the escape of pus there is
abatement in the intensity of the pain,
early disappears in a few hours and
ng in a few days.

ition and Difficult Eruption.—It is
oon to find certain of the temporary
ly set in the adult jaw, and occupying
of the gum. One of such abscesses
ent tooth is usually present in the
jaw, but it has been retarded in
by being too deeply embedded in the
section may also be due to abnormal
of growth. Such teeth may appear
after all the others are lost, and the
lying them has been absorbed and so
hem. When these cases do occur they
nsile for the popular but incorrect
third set of teeth. An impacted tooth
ves rise to any trouble, unless it be an
lower wisdom, particularly the latter.
g of these teeth is sometimes accom-
distressing symptoms, which may be
l for months or years, unless they are
by extraction of the tooth. This con-
usally due to imperfect development.
The tooth usually takes its natural
ition, but, being wedged in between in
ment and the ascending portion of
behind, or to such diseases as mercury or
table. The overlying gum is apt to
by the occlusion of the opposing
average jaw; inflammation is there-
up, and being maintained by biting
id to the surrounding parts. Swallow-
less painful and the motion of the jaws
When it is evident that there is in-
accommodation in the jaw for the
tooth it should be removed.
mination of the gums, though not a dis-
the teeth proper, is one of the most
as of the premature loss. It may
a constitutional causes—chronic dys-
matism or gout—or from the ad-
on of such drugs as mercury or iodid-
um. Most often, however, it results
presence of tartar about the necks of
, and lack of thorough cleansing.
e to constitutional causes, their ap-
remedies are called for; but when
presence of tartar, this deposit should
lly removed.
ache.—Other diseases of the teeth are
only suffered, and more obscure. The
dentist should be sought on sus-
ta from a large abscess in the gums of
aching tooth is a symptom of dis-
ease which requires instant attention. When
due to carries with or without simple exposure
of the pulp, the attack is brought on by taking
hot or cold, sweet or acid fluids, and is seldom
of long duration. To afford relief in such cases
these, gently wash out the cavity with a solu-
tion of carbonate of soda; then, drying it care-
fully with a piece of cotton-wool, take a very
small pellet of wool dipped in eucalypthus oil and
placing it in the bottom of the cavity; then place
piece of cotton wool large enough to
fill the cavity and saturated with the following
solution: one dram of mastic in one and
half ounces of eau de Cologne. This should be
changed daily. When the pain is caused by the
forming of an alveolar abscess the tooth will
be found insensitive to change of temperature
but very susceptible to pressure. The patient
now becomes feverish, and the pain, which is
at first of a dull heavy character, becomes more
intense, throbbing, and continues, till pus has
been formed and discharged through the gum.
Provided the tooth is likely to prove useful and
the patient cannot consult a dentist, the gum
should be carefully painted with tincture of
iodine, or the old-fashioned plan of putting a
roasted fig over the root may be resorted to;
at the same time it is well to give an aperient
such as Epsom salts, followed by a full dose
of quinine—six to eight grains for an adult.
Great relief follows this treatment, which is, of
course, only temporary. If an abscess shows
signs of pointing on the gums it may with ad-
antage be lanced. Poultries should never be
applied to the face, for heat tends to draw the
pus outward. Abscesses in connection with the
lower wisdoms often assume a very serious
character unless cut short by extraction of the
tooth.

Hygienic Care of the Teeth.—Many of the
diseases of the teeth and gums might be pre-
vented or greatly retarded by proper attention
to the cleansing of these organs. The imple-
ments best fitted for this purpose comprise the
quill toothpick, waxed silk thread and brushes,
with suitable powders. The toothpick ought to
be used after every meal, but it should be sup-
plemented by the use, between the teeth, of floss
silk, which will remove deposits accumulating
where contiguous teeth touch. The brush is
used to remove all deposits solid and mucous,
and it gives the teeth a bright and polished ap-
pearance; its mechanical friction, too, stimulates
the gums to more healthful action. An excel-
lent tooth powder is composed of precipitated
chalk, two ounces; light magnesia, two ounces;
oil of cinnamon, eight drops; thymol crystals,
four grains; otio of roses, 10 drops. The teeth
should be brushed twice daily, in the morning
and in the evening. The manner of using the
brush is more important than many people sup-
pose. The general method is to brush horizon-
tally, but a moment’s reflection will show that
this leaves untouched the very situations most
in need of cleansing. The brush, used properly,
should be pressed against the teeth and the
handle rotated so as to make the bristles sweep
together and between and over them in this case
with an up-and-down motion will thoroughly
cleanse the interspaces; the inner surfaces of
the back teeth are best cleaned in a like man-
ner, while the corresponding parts of the upper
day and lower incisors are easily cleaned by
vertical drawing movement. The brush should
TEFFT, Benjamin Franklin, American Methodist Episcopal clergyman, college president and diplomat: b. Floyd, N. Y., 20 Aug. 1813; d. Brewer, Me., 16 Sept. 1895. He was graduated at the Wesleyan University in 1835 and in 1839 entered the Methodist Episcopal ministry. He held pastorates at Bangor and at Boston and in 1843-46 he was professor of Greek and Hebrew at Ashbury, Ind. (now De Pauw), University. He edited the Ladies' Republic, 1840-52; was president of Greensboro College, Lima, N. Y., in 1851-54, also editing the Northern New Yorker in 1852-54; and held pastorates at Bangor in 1858-61. He was appointed United States Consul at Stockholm and acting minister to Sweden in 1861; and in 1864 was made commissioner of immigration from northern Europe for the State of Maine. In 1873 he edited the Northern Border at Bangor. Author of 'Prison Life' (1847); 'Hungary and Koszuth' (1852); 'Webster and His Masters' (1853); 'Methodism Succeasful' (1860); 'Evolution and Christianity' (1865), etc.

TEGEA, Arcadia, city of ancient Greece whose site was near the modern Tripolitsa. It was situated on the southern portion of a plateau nearly encircled by mountains, the northern half being occupied by Mantinea. It was a highly fertile region, but was subject to floods because of an insufficiency of outlets through its mountain barriers and together with Mantinea was dependent upon underground drainage conduits. This common dependency was a cause of frequent wars with Mantinea while Tegae's natural position controlled chief roads leading from Laconia to Argos across the Isthmus, and the Spartan League but did not do otherwise deprive it of its independence. It was a member of the Arcadian Confederacy after the battle of Leuctra in 371 B.C. and later belonged to the Aetolian League, which held a place of importance after the Roman conquest of Greece, but in 404 B.C. it again became Sparta's ally. It was vacated in 1899. The excavation of its ruins was begun in 1879. Its most important building was the temple Athena Anea, rebuilt by Scopas in 395 B.C. It was a combination of Doric, Ionic and Corinthian architecture, 72 by 154 feet; the sculptures also were by Scopas and represented the slaying of the Calydonian Boar and the combat of Telephus and Achilles. While these are in fragments they were evidently in the best manner of Scopas. Consult Curtius, E., 'Peloponnesos' (1851); Mendel, G., 'Bulletin de correspondence hellénique' (Vol. XXV, 1901); Gardner, E. A., 'Fragments of Greek Sculpture' (1815).

TEGENSEE, Germany, village and mountain lake resort in the province of Upper Bavaria, on Lake Tegernsee, 32 miles southeast of Munich, 2,300 feet above sea-level. It has a castle which originally was a monastery founded in 719; a parish church of the 13th century; and an orphanthropy established by Duke Charles Theodore of Bavaria. It is much frequented as a summer resort, the lake and the fine mountain scenery offering many attractions. Pop. about 1,900.

TEGNER, têng-nér', Essaas, Swedish poet: b. Kirkerud, Wermland, 1782; d. Vesle, Smaland, 1846. He was graduated at the University of Lund in 1803, became (1812) professor of Greek literature and member of the Swedish Academy, was ordained priest and in 1824 was appointed bishop of Vesle. As a poet he struck out a new path in Swedish literature. His first attempts did not meet with much acceptance, but at length he came to be regarded as the greatest poet of Sweden. His poetry is characterized by inexhaustible vitality, rich, fancy and lively feeling. His most notable work and the dream on which the whole of his work is based was the epic, translated into English. Its great value lies in its accurate reproduction of the legends that are included. He also wrote the national songs and 'Children of the Lord's Supper,' translated by Longfellow. His works were collected and
by Böttiger, his biographer (1847–
ec ed. 1882–85). The later years of
were spent in a retreat for the insane
a paralytic couch. (See Firth's
Consult Boyesen, H. H., 'Essays on
Riordan Literature' (New York 1855);
'Essais Tégnér' (Stockholm 1896).

JICIGALPA, tâ-goo-sé-gálpä, Hon-
se capital of the republic since 1880
se department of the same name, sit-
the Choluteca River, 60 miles north-
the Gulf of Fonseca. It is one of the
central cities of the department. An
imposing bridge connects it with
the Port of Comayagua. The government
is a central institute with subsidized
and five normal schools. Its cathedral
is the principal church and there are
five other churches, a university and
sepretious public buildings. Gold
r mines are worked in the neighbor-
ich is also a fertile agricultural dis-
p. 28,950.

JEXIN, té-gék'sin, a lizard. See

ERAN, tēh-ch-rān, Persia, (1) Capital
ince of the same name, at the north-
about 66 miles south of the Caspian
lies on an elevated plain, with the
of Elburz and Demavend rising at
and east, 20,000 feet being the eleva-
thed by the latter volcanic peak. The
factions were demolished and others
pleted in 1874. A fine promenade
on the site of the old walls and the
fifications are on a plateau 3,230
an area of about 10 miles. The prin-
ents extend from the 12 gates to the
azar, which displays a great variety
it and foreign goods. The ark is
ial feature and is the name given to
el and its enclosures, chief of which
some palace of the shah, with its
ounds and fountains. There are
chools, including a Koran school and
broadly speaking, numerous mosques, the buildings of
ication and of other legations are
ed notice and the suburbs lying at the
he Elburz hills, contain many charm-
iansque in character. In the in-
other. The ruins of Rei, in the vi-
er among the most remarkable of
ater supplied to the town by 30 sub-
als, is brought from the north-
nd in 1886 a tramway was con-
to Shah Abdul Azim, a place of pal-
outh of Teherán and others were built
various sections of the town. Gas
used in 1892 to light the city. Harun-
d was born in the vicinity. The man-
clude carpets, silks, cotton goods
ware. In 1913 the police service of
was turned over to the control of
icials, the Swedes having largely
the Persian army. Pop. (est.) 280,000.
province of Teheran is divided into six
aining much fine agricultural land-
ous villages, two of which are held in
the British and Russian governments.
ly. There are fine coal fields in Kas-
streets in abundance in rich Veramin
s watered by the Jâfrdâ River. The

chief products are fruit and grain, wheat, barley
and rice. A railway, passing through Mesol-
potamia, connects the Mediterranean with the
Black Sea and the Gulf of Persia. It furnishes
an all-rail route from Calcutta to the British
Channel and shortens the distance from Te-
herân to Constantinople by two weeks.

TEHUANTEPEC, tâ-wân-tâ-pék', City of,
situated in the state of Oaxaca, Mexico, 18
miles from the Pacific Ocean, is the centre of
a fertile and productive country in which coffee,
sugar and other tropical products are largely
grown. It has a considerable trade in cotton
which are raised on adjacent lands. The city
is an important station of the new inter-oceanic
railway. Pop. about 18,000, including a large
number of persons of Indian extraction.

TEHUANTEPEC, Isthmus of, comprises
that section of the Republic of Mexico within
the states of Vera Cruz and Oaxaca where the
Gulf of Mexico and the Pacific Ocean approach
nearest one another, the distance from the
mouth of the Coastzacoalcos River, on the east,
to the port of Salina Cruz, on the west, being
437 1/2 miles. This point is one of the few
stances where a depression exists in that
vast chain of mountains which extends from
north to south along the western shores of both
American continents. At Tarifa, the lowest
point of the summit level, the altitude is but
754 feet above the sea. Cortes, searching for
a safe harbor for his ships, discovered the
Costaacoalcos River, wide and deep where it
empties into the Gulf, and pronounced it
the finest in Mexico. Informed of the narrow
strip separating the two oceans, the Spanish
was evidently impressed and at once grasped
the idea of inter-oceanic communication at this
point. With prophetic insight and influenced
by the enormous advantages which were cer-
tain to result to the isthmus by the construc-
tion of a ship canal, Cortes located a vast land
grant, presented by his sovereign, in close
proximity, and chose for a title the Marquis of
Tehuantepec. His successors caused super-

duceal surveys of the coast to be made and
were convinced that no serious obstacles pre-
vented building a ship canal and, considering
the diminutive proportions of vessels at that
time, the enterprise was well within the engi-
neering powers of the time. It was proposed to employ native slave labor in its
construction. Political and strategic considera-
tions prevented the Spanish government from
ever encouraging the enterprise. When Mexico
became independent it was too much engaged
in restoring order to give attention to internal
improvements and it was not until 1842 that a
cession for opening a line of communication
by canal or railway, or both, was granted to
Don Jose de Garay, a citizen of that country.
Accurate surveys were made and a practicable
route selected, but, for lack of financial en-
couragement, the concession was afterward sur-
rrendered. Until 1852 capitalists of the United
States betrayed no special interest in the enter-
prise, but when the extension of railroads from
California and Oregon was assured, the im-
portance of more rapid communication between
the East and West was quickly realized. In
that year the Barnard and Williams expedition
was dispatched to the isthmus to survey a route
for an inter-oceanic railway. These explorers
made very careful surveys of the entire route and pronounced the enterprise perfectly feasible, but were subsequently ordered out of the country, the introduction of American capital not being encouraged by the Mexican government, so soon after the war between the two countries. In 1871 the expedition under Commodore Shufeldt was dispatched to the isthmus by the United States government to make a final survey and finally determine whether a ship canal could be built over the route or not. The result of the survey was a decision that a ship canal, capacious enough for modern vessels, was not practicable owing to insufficient water supply for the upper levels. This expedition also reported adversely to the lagoons, which indent the western coast and were considered the natural location for a terminal harbor, on account of certain unfavorable physical conditions there existing. A new location for a terminal was chosen at Salina Cruz, a few miles westward of the mouth of Tehuantepec River, where greater depth of water was afforded, as well as more complete shelter from the prevailing winds.

The Eads Ship Railway.—In 1883 James B. Eads, a distinguished engineer, conceived a plan for the construction of a railway over the isthmus by which vessels of the largest dimensions could be transported by rail at a speed of 10 miles an hour. The details contemplated the deepening of the Coatzacolco River for a distance of 20 miles to the town of Minatitlan, which was to be the eastern terminus. The western terminus was to be at Salina Cruz. At these points giant pontoon docks were to be located and three lines of railway of standard gauge connected the two points. As a vessel sailed over the psoaons it rested upon a railway carriage, secured from all strain by ingeniously contrived supports. Raised to the level of the tracks the carriage was connected to three powerful locomotives and with its load carried across and deposited into the dock at the other terminal. The length of the railway was to be 165 miles, with a very substantial roadbed and with not greater than 20-mile curves. Where abrupt curves existed, they were to be avoided by turntables at five different points. Vessels in transit were thus always in a straight line. The plan after being subjected to much criticism was at last endorsed by the highest engineering authority in the world and would probably have been built but for the death of its projector in 1887. Its cost was estimated at $75,000,000. Mexico granted 1,000,000 acres of public land in its aid. Thus for three and a half centuries every plan conceived for the attainment of communication over the isthmus having failed, Mexico determined upon the construction of the railway as a national work and spent $30,000,000. Finally about 1897 the railway was opened to a length of 122 miles, but the impending opening of the Panama Canal greatly reduced its importance.

TEIXEIRA DE MATTOS, tá-shär‘ē dā mà’tōs, Alexander Louis, English journalist and translator: b. Amsterdam, Holland, 9 April 1865. He settled in England in 1874, was educated at Beaumont College, Old Windsor, and entered upon journalism. He has been for some time as correspondent and as associate editor on various periodicals and has published translations of Melani van Java’s ‘Resident’s Daughter’ Zola’s ‘Curée’; ‘Memoirs of Chateaubriand’; Zola’s ‘Grande Illusion’; Josine Holland’s ‘Leida’; ‘The Cradle’ (from the Flemish) and some of Maeterlinck’s tales.

TEJUI, or TEQUEXIN, a large lizard (Tupinambis teguixin), inhabiting tropical America. The upper parts are deep-black mottled with green and yellow; the sides show two rows of white spots; and the under parts are yellow, marked with black stripes. A full-grown specimen may be three feet in length, mostly tail. These lizards frequent forests and plantations, are carnivorous and their strength and speed enable them to overpower a number of animals, including barnyard chickens and eggs. They are consequently hunted, not only as pests, but because they are themselves good to eat. They dwell in burrows, lay hard-shelled eggs in the ground and defend themselves by vigorous lashing of the tail. They have some resemblance to the Egyptian Parauus gives them the borrowed name of salvator in some places. This lizard represents an American family, the Tejide, with long forked tongues largely covered with scale-like papillae. The teeth are solid and implanted almost on the edge of the jaw and are therefore intermediate between acrodont and pleurodont. The body is covered with small scales (osteoderms are absent) or the skin may be simply granular above; the under surface is covered with larger scales generally arranged in transverse rows. This large family, says Gadow, “which comprises nearly 40 genera with more than 100 species, exhibits great diversity of form. Some are inhabitants of forests and are arboreal, while others are strictly terrestrial, preferring hot and sandy plains, or they dwell below the surface and are transformed into almost limbless and scaleworm-shaped creatures. Representatives of the family are spread from Texas and Utah to the borders of Patagonia.

TEKELI, té-kēl‘ī, or TOKOLY, té-kol‘ē, Emmerich, Count of, Hungarian noble: b. about the middle of the 17th century; d. Vienna, 1705. His father had headed an insurrectionary movement against Austria and he himself was chosen by the Hungarians in 1678 their commander-in-chief. He broke into Upper Hungary, captured several fortresses and towns, devastated Moravia and penetrated into Upper Austria. The emperor consented to redress several grievances at the Diet of Oedenburg (1681); but the insurgen were not satisfied and refused to lay down their arms. Tekeli now put himself under the protection of the sultan Mohammed IV, by whom he was declared king of Hungary. A war between the emperor and the Porte ensued in which the Turks advanced (1683) as far as Vienna, but were totally defeated before that city, by John Sobieski, king of Poland (12 Sept. 1683). The campaign continued without success. He fell under the suspicion of the
who sent him a prisoner to Adrianople. Meanwhile his wife was besieged by
trians in the castle of Munkács, where out for three years, until she was com-
y fame in the face of the.der. In the same year he was con-
s discovered the groundlessness of picions of Tekeli and he once more re-
e support of the sultan, who designated
n of Transylvania. He penetrated t country and routed the imperial gen-
90, but in the same year he was con-
y Louis, margrave of Béren, to retire. ened in all the struggles between Aus-
 Turkey till 1697, when the Peace of
 was concluded, in which Turkey re-
the cause of the Hungarians. Tekeli
red to the dominions of the sultan, who
 upon him several estates, with the
 prince of Widdin.
EL AMARNA. See TELL EL AMARNA.
. EL KEBIR. See TELL EL KEBIR.
AUTOGRAPH, an instrument for the
uous transmission of a facsimile copy
ng or pen drawing. The Telautograph was
 by Elisha Gray, who invented the
us to his particular form, but it n
 extended to cover varieties of ma-
ving the same purpose. In Gray's ap-
 the transmitting pen is connected by
d means by which means of the pen
se a pulsatory cur-
pass into two telegraph wires. These
 currents produce rapid pulsatory mo-
 armature of a system of electro-
, means of which the receiving pen
 d to follow the motions of the trans-
Another electro-magnetic arrangement
 e of the paper at the
 each line, while still another moves the
 up to the next line from the
 commonly used a pencil is employed of a
 for transmitting and a con-
 roll of paper is provided at both the
 er and receiver. The writer or sender
 s a lever to shift his
 n motion is conveyed electrically in
 roll at the receiver. The receiving
 capillary glass tube at the junction of
 t metal arms. This glass fountain pen-
 automatically all the movements of
 pollicil, so that either words, pic-
s are accurately duplicated. This
 can be used on the same wires as a
 without disturbing the use of the
 does not require an operator at the re-
 end, and interception of the message
 taping is impossible.
modified form of telautograph known
elechirograph, invented by Gruhn, a rad-
d here receiving apparatus is used. The
 currents influence two electro-mag-
 etic in the form of a small coil on the
 mirror; a light ray from a small incandescent
 lls upon the mirror whence it is re-
 o a sheet of sensitized paper. The mir-
 ead by means of cement to a small
t in the form of a small coil on the
 rest upon a set screw upon which the
can oscillate. Beneath the two other
 extend two armatures subjected to the
 of the electro-magnets. These arma-
degree oscillations of the receiving and the
rent movements of the transmitting pen-
cil; they are carried by flat springs, and the os-
cillations are given to the iron plate and, of-
course, to the mirror fastened to it. Before the
message can be delivered the receiving shee
must be developed; the apparatus for this is
: when the message is completed a small
lectric motor operated by an independent bat-
tary in the receiving room is set in motion; this
motor works a train of wheels or rollers which
draw the portion of the film written upon by
the light ray through a developing bath and out
again through a pair of rubber drying rolls.
The completed message is delivered in less than
35 seconds after the transmitting operator has
placed his pencil in its rest.
TELECHIROGRAPH. See TELAUTO-
GRAPH.
TELEDU, a badger (Mydas meliceps) of
Java, which is skunk-like in its habits, and in
the copious and far-reaching vuleness of the
secretion in its anal glands.
TELEGONY, the inheritance by offspring
of the characteristics of some previous mate
one or both parents. That such a character
 has long been the belief of breeders of live-
 stock, who spoke of the phenomenon as "throwing
back." Until about 1890 scientific men gen-
erally lent their support to this theory, although
Weismann long ago expressed serious doubts.
About 1895 Ewart began a series of careful
experiments at Penicuik, near Edinburgh, Scot-
land, and certain others were undertaken in
Germany and Brazil, the outcome of which was
to show that the phenomena noticed were
evidences of atavism, or reversion or variation,
and that no such a thing as telegony existed.
See HEREDITY.
TELEGRAPH BATTALIONS. The gen-
eral duty of signal troops is to collect and
transmit information, to assist in providing se-
curity for troops, to assist in directing fire
attack during combat, to provide means for
ready verbal and written communication be-
 tween distant commanders and troop leaders,
to facilitate the transmission of verbal and
written messages and orders, to insure the
secrecy of such messages when necessary by
means of codes and ciphers, to exercise super-
vision over the character of matter transmitted
by means under its control, and when circum-
stances make it necessary, to fight in order to
accomplish any of these objects.
The work of signal troops assigned to lines
of information in war varies with the nature
of the lines which they control, viz. (1) The
maintenance and operation of electrical lines
of information from the capital of the nation
to the headquarters of the armies in the field.
(2) The construction, maintenance and opera-
tion of the radio stations and central permanent
telephone and telegraph lines connecting the
headquarters of each army in the field with
its various divisions and other units, and the
necessary camp telephone and telegraph lines
within these armies. These lines are included
in the zone of the advance.
The signal organizations assigned to both
these classes of duties are called Telegraph
Battalions. In the first class they are distrib-
uted along the lines and at stations as required
for construction, maintenance and operation
without being supplied with the special tech-
technical equipment and transportation required in the
field. They operate the telegraph cable and radio offices and the telephone systems with substantial aid from the same apparatus used in times of war. These systems have taken the seat of government through the zone of the line of communications up to army headquarters. For maintenance, repair and extension the material and equipment supplied is the same as in commercial practice.

In the second class of work signal troops must install and operate lines under quite different conditions. The poles and wire must be light and the instruments of special design for a service unlike that encountered in commercial practice. For administrative purposes the telegraph battalions employed in this class of work are organized into companies, and these in turn into sections, each equipped with supplies and transportation for installation of a complete telegraph or telephone system in the mobile units with which they serve. The telegraph battalion prescribed in the tables of organization consists of two companies. Each company has six sections—three telegraph and three telephone. A telegraph section is equipped to install 20 miles of wire on lances with three telegraph offices. The equipment is carried in one wagon of the escort type and one lance truck. The 10 men of the section furnish the linesmen, operators and the transportation for the construction, maintenance and operation of 20 miles of line. The telegraph equipment and personnel of the company is sufficient for 40 miles of line and that of the battalion for 120 miles. A telephone section is supplied with material for the installation of a telephone system of 20 telephones connected with a field switchboard and 20 miles of insulated wire laid on the ground or supported on lance poles. The equipment is carried in two telegraph wagons of the escort type and the lance truck. Twenty-one men make up the switchboard operators, linemen and messengers needed. The equipment of the telegraph battalion is necessarily bulky and heavy and its mobility in general is limited to that of the supply train.

**TELEGRAPHPHONE**, a recording telephone, the invention of Valdemar Poulsen, of Copenhagen. He devised a magnet of sufficient delicacy to limit the magnetizing of a metal plate to the direct point of contact, no matter how minute that point might be. His magnet, in tracing its course over a steel disc, magnetizes only the molecules of the steel with which it comes into direct contact. Thus localized and defined, electro-magnetism becomes controllable. The result was a mechanism that recorded the sounds given into a telephone receiver, on discs that could be mailed like letters, and reproduced by the recipient. This interesting machine failed of commercial success. Consult Scientific American. Sup. (Vol. I. XIll, No. 10, 28 Feb. 1902).

**TELEGRAPHY.** The word telegraphy is derived from the Greek, tele, "far off," and graph, "to write." In the modern practice of telegraphy, however, the term has a wider meaning and is used to signify any means by which intelligence is transmitted to a distant point by means of wires. In this sense the word would also include the transmission of speech electrically to a distance, but inasmuch as that highly important art possesses its own appellation (telephone) such use of the word is unnecessary.

From remote times methods of communicating intelligence to a distance have been employed for purposes of war and defense. The Greeks were perhaps the first to adopt systematic methods of telegraphing, and a description of a telegraph system that was employed 300 B.C. is to be found in the writings of the Greek General Polybius.

**Polybius Telegraph.**—The operation of this system was as follows: At each station there were two walls about seven feet in length and about six feet in height, separated by a space of three feet. At night or more torches, as desired, but not exceeding five in all, were placed on top of the walls, and certain combinations of the torches represented the letters of the Greek alphabet. A tablet showing the combinations of torches for the various letters was provided at each station. For instance, two torches on the right-hand wall and three on the left wall would represent the combination g which was on the right wall and four on the left, y, and so on. When it was desired to signal a station, two torches were set on a wall, which signal was answered by a similar arrangement of torches at the other station. The operator then proceeded to spell out his message by placing the torches in the required combinations, one letter at a time. The tablet mentioned was divided into vertical and five horizontal rows of squares, each letter of the alphabet being allotted a certain square, beginning at the upper left-hand corner with A, and running horizontally across the tablet. Any letter could thus be found by giving the number of vertical and horizontal rows at the intersection of which the square allotted to that letter. For instance, the letter Y would be at the intersection of the fourth horizontal and the fifth vertical rows. The code thus formed, in a more or less modified form, is in use today by the military departments of various countries as a means of telegraphing maps of a locality.

**Fire and Smoke Signals.** The use of fire by night and smoke by day has long been practiced by even the most uncivilized races, as a means of communicating intelligence to a distance. In numerous places in this country there still remain evidences of this practice by the aborigines, in the shape of mounds on hill tops and other points of advantage, on which the accumulated ashes of beacon fires of hygroscopic years may be found beneath the roots of trees of gigantic size. In the country between Chillicothe and Columbus, in Ohio, for instance, may be traced over 20 such mounds, so related to one another that if all the trees were removed fire signals might be transmitted from one end of the valley to the other in a few minutes. To this day the Indians of North America practise this method of approach of enemies in their territory; and up to within a comparatively short time such fires were the most favored methods of signaling the approach of an enemy in Great Britain and other European countries.

**Semaphore System.**—It was not until the end of the 18th century that any comprehensive
maling was employed in Europe or in ry. The plan then introduced was a as the Chappé semaphore system of

This semaphore resembled the sema-

common on all railways to-day, con-
am upright post, on the top of which
arms or blades are pivoted, but in è semaphore the arms were arranged current from those of the ordinary
technique. Thus the crossarm on the top
was 14 feet in length, and on that
arm a shorter arm was pivoted
ages to the longer arm. By a sys-
tese and pulleys these arms could be
ed by the operator and placed in
cent positions, certain positions of
representing given letters of the al-
thence by appropriately placing the
manipulator could spell out words
ages which an operator at a distant
d read and, if necessary, retransmit
station further on. These sena-
re placed on substantial stone towers
as apart ranging from six to 10 miles,
se spread rapidly throughout Europe,
, Germany and Russia especially the
widely used. For example, a string
aphone towers, extending from the
frontier to Petrograd, via Warsaw,
of over 1,200 miles, and employing
operators was erected at great ex-
.
Cologne and Coblenz, was estab-
32, at a cost of 170,000 thalers. In
ere was a semaphore line from Paris,
475 miles apart, and requiring 120

transmission of signals by semaphore
as necessarily slow (about one signal
!); inasmuch as each signal was veri-
ceiving station before another
itted. The time taken in transmit-
letter from Paris to Toulouse
over, comparatively speedy, namely, 10
ites.

tore signaling is still usefully em-
some countries for communicating
to shore, between coast-guard sta-
classes, etc. One plan of this
ost the use of two small flags, one
ach hand. The flags are about 18
are, the staff is about three feet in
etters of the alphabet are repre-
positions in which the flags are
re held. With the aid of a telecog-
y be transmitted by this method to
of three miles in fair weather.
ay also be read by the use of the
e, employing the same alphabet, in-
e this termed the human sema-

C Telegraph Systems.—Although up
umber of visual systems of telegr-
h as the semaphore system, were,
in quite extensive use, electricity
utilized experimentally long prior-
t for purposes of telegraphy but
in this direction was slow and the
with which its commercial utility
ere evidenced is evidenced by the es-
tablishment of semaphore stations
ed, long after the possibility of
electric telegraphy had been more or less
clearly indicated.

In 1774, Lesage of Geneva constructed an
electric telegraph system which employed in
its operation 24 line wires, one for each letter
of the alphabet. At the terminal of each wire
pitch balls were suitably suspended, and, taking
advantage of the well-known repellant effect
that follows the similar electrification of such
light substances, Lesage, by the use of fric-
tional electricity applied to the wires, trans-
mitted intelligible signals over them. In 1815
Francis Ronalds of England improved on this
arrangement. A revolving dial, operated by
clock-work, was employed at each end of a
wire. The dials rotated synchronously. A
notch was cut in each dial, behind which the
letters of the alphabet were placed in a circle,
so that as the dial revolved the letter at a
time was seen through the notch. Pitch balls
were electrically connected at each end of the
wire. At a given signal the dials were set in
rotation and as the notch arrived a particular
letter the pitch balls were actuated electrically.
The letter was noted and in that way messages
were transmitted. In 1774 Volta had dis-
covered that electricity could be generated by
means of the "voltaic" battery and, availing of
the current from such a battery efforts were
made, with more or less success, between the
years 1806 and 1830, to utilize the electrolytic
property of an electric current to decompose
chemical solutions at the distant end of a wire
to indicate telegraph signals. These experi-
ments were the precursors of others more suc-
cessful in the line of electrochemical telegraph
systems of later years, and to which further
reference will be made herein.

Needle Telegraph Systems.—Availing
of Oersted's discovery that a pivoted mag-
netic needle is deflected from its normal position,
parallel to a wire, when an electric current
passes in that wire needle telegraph systems
came into existence and were extensively
employed in Europe at one time and are yet in
use there. For this purpose a magnetic needle
is pivoted in the centre of a coil of wire, and
a pointer suitably attached to the needle, swings
in front of a dial. The needle and pointer can be
deflected by either hand or by changing the
direction of the current through the coil.

Certain deflections of the needle to the right or left,
combinations of deflections to the right and left
represent the letters of the alphabet, and these
deflections are produced by sending over the
wire current pulsations in positive or negative
direction, or alterations of both, as required by the
letter to be transmitted. For instance, if the Morse
alphabet were used, a motion to the right would
represent a dot; one to the left a dash. The
alterations of polarity are transmitted by a
"drop-handle" or a "tapper." The tapper is
similar to the double-sending key used in
submarine telegraphy. (See Fig. 15.) A needle
system employing two needles has also been
used. This required two wires, but gives a higher
rate of speed—about 15 to 20 words per minute.
The operator reads incoming signals by observ-
ing the movements of the needle or needles.

Bright's Bell.—A modification of the
needle telegraph is that known as "Bright's Bell,
which in which the bells of different tone are struck
by a hammer, one tone representing, for instance, a dot; the other, a dash. In other instances, the needle of the needle system is caused to strike metal tubes of different tones, one tone indicating a deflection in one direction, the other tone a deflection in the opposite direction. These have been termed acoustic telegraphs.

Electric Chemical Telegraphs.—See Automatic Telegraph Systems in this article.

Morse Electro-Magnetic Telegraph.—In 1824 Sturgeon of England discovered that when a current of electricity is caused to flow in an insulated coil of wire, surrounding a bar of soft iron (that is, well-annealed iron), the bar takes on magnetic properties, and when the current ceases to flow in the coil the iron at once loses its magnetism. Employing these electromagnetic phenomena, Morse, in 1837, invented the telegraph system which bears his name, and which to-day is in extensive use in one form or another in every part of the world. It was then known that when a piece of soft iron is placed near a magnet there is a mutual magnetic attraction which tends to draw them together. This fact is also availed of in the Morse telegraph system as will be shown in the case of the Morse relay and sounder.

To obtain the flow of current in the coil of wire required to magnetize the iron bar, the circuit must be complete, and a source of electromotive force must be provided.

An electric circuit may be represented, as in Fig. 1, by a line or wire, W; battery, B, the thin and thick lines of which in the figure conventionally represent the positive and negative plates or elements of a primary chemical battery. The source of electromotive force in telegraphy for many years in this country was the "bluesine" or "gravity" battery, the elements of which are zinc and copper in a solution of sulphate of copper in a glass jar. These cells are arranged in series: two or three for local circuits and from 25 to 350 for main line batteries. Of recent years these batteries and the bichromate primary batteries employed in Europe, have given way largely to storage batteries and dynamo machines as a source of electromotive force.

When dynamos are employed they are in some cases designed to develop about 70 volts each. Several of these machines are connected in series so that by tapping the machines at different points an electromotive force of 70, 140, 210 volts, etc., may be obtained. In other cases dynamos developing 70, 140, 300 volts, respectively, are employed. Two sets of such machines are provided, one set to furnish positive polarity, the other negative polarity, as much as is essential in the practice of telegraphy to utilize currents of opposite direction or polarity; instances of which will be noted in connection with the descriptions of quadruplex telegraphy in this article.

Reverting to Fig. 1, G is a galvanometer; an instrument to indicate the presence of electric current in a circuit, and which is connected on the principle of the iron needle of needle telegraph systems already mentioned. The direction of the current when the circuit is assumed to be from the positive pole of the battery B to the galvanometer G and back to the negative pole of the battery B; the key K affords a ready means of "breaking" and "closing," or of "making" and "holding" the circuit. When the key is closed, or the circuit is complete and current flows, the key is "open" or up, the circuit is broken, and no current flows. There is no difference between the ordinary telegraph circuit without instrucional means for completing the circuit from end to end.

In the Morse telegraph system, current is transmitted electronically from one station to another by the opening and closing of the circuit, or, by means of the short and long intervals, which actuate the Morse relay and sounder and register the sound of the Morse alphabet.

In Fig. 3 is shown theoretically the arrangement of apparatus of a Morse telegraph circuit at two terminal stations, X, Y. S is the battery; K is the Morse key. S is a core or bar, arranged in the shape of a shoe, around which a coil of fine wire is wound. A is a small piece of iron, the "armature," which is mounted pivoted lever r. A retractile spring e draws the armature from the electromagnet W, and when the latter is demagnetized the lever is released by the front one of which is a key that acts as a key for a local circuit. C are included small battery B, the sounder s. The relay R consists of the iron core, S, the coil of wire, and lever r. It also has devices for...
TELEGRAPHY

The armature relative to the ends, and screw posts for facilitating connections of the wires leading into and out of the instrument. (See Fig. 5).

In using the sounder in telegraphy is to obtain louder sound than that produced by the Morse relay. The relay developed in a given electro-magnet, relay or sounder, increases with the square of the currents, also with the number of turns of wire in the coils, within certain limits, up to the point of magnetism of the iron, the resulting magnetism proportioned to the product of the strength in amperes by the number of turns, or turns, of wire; which product the "ampere turns." Saturation is seldom or never reached in the magnet telegraph. Again, with a given force the current strength is proportional to the resistance of the wire as the resistance of a wire of given number of turns of a given gauge of wire, the weaker will be the current. That to produce the clear, loud, click sound of the Morse sounder, about .25 amperes, while a main line relay will only require about .01 amperes. To operate a sounder placed in a line of 1,200 ohms resistance would require a motive force of about 300 volts. It is more economical and in other ways employ a lower electro-motive force. The volt in this case, and a relay having as of finer wire than the sounder (30 B & S gauge) and a light armature designed to produce a large volume of sound by means of its armature a "logical" battery is then caused to sound as indicated in Fig. 1.

A sounder is constructed on the same principle as the relay, but the wire with which it is larger, about No. 24 B & S gauge, mature and lever are heavier. Since the relay controls the local circuit, sounder it follows that as the main end and opened, thereby closing and opening the relay, the local circuit will be opened and closed, by which actions the magnet of the sounder will be corded alternately magnetized and demagnetized, and the armature lever will be attracted by the magnetism and withdrawn by the tension of the armature spring. The motions of the armature produce the long sounds which are translated into letters habed by an expert operator. When register or ink recorder is used in the sounder these dots and dashes are recorded or printed on strips of paper. The message may then be transmitted to any one familiar with the dot and dash language.

Plainly many more relays may be used in the main circuit than are shown in the diagram, and 40 relays in one Morse telegraph with two main batteries, one at each end. When any one of the keys of a telegraph circuit is open none of the keys can close the circuit, and one key is operated at a time. The wire will be operated concurrently, of the opening and closing of the key. Any attempt to operate two keys at once on this circuit results in a clashing of signals. Such circuits are termed "single" or "simplex," inasmuch as but one message at a time can be sent over them. This fact distinguishes simplex from multiple circuits over which two or more messages can be transmitted simultaneously, instances of which will be given herein.

The arrangement of Morse circuits just described is termed the "closed circuit" method of operation, from the fact that the circuit is normally closed with current on the line. In Europe the Morse circuits have generally been operated on what is termed the "open circuit" plan, which consists in so arranging the apparatus that the battery shall only be placed to the line when a message is to be transmitted; at other times the battery is disconnected from the line. For this purpose a key with front and back contacts is used, similar to K in Fig. 12; battery being placed as there shown, and the receiving instrument being placed in the circuit of the back contact at s in that figure. In the open circuit method battery is necessary at every station.

Telegraph Alphabets.—The American Morse code or alphabet which is in general use on overland Morse telegraph lines in the United States and Canada is composed of dots and dashes and of combinations of dots, dashes and spaces. Letters made up partly of spaces are termed "spaced" letters. The letters C and R are instances of spaced letters. (See illustration below). Dots, dashes and spaces are formed by the length of time during which the key or other transmitting instrument may be held closed or open; the

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<th>LETTERS</th>
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and is insulated therefrom by a hard-bushing. On its top there is a cone cap, termed the anvil, carrying a contact point. At a point under side, directly above the lever, a lever 1 is provided with a platinum tip termed the hammer. A curved strip on 9, the "circuit closer," is pivoted on 6. When the circuit closer is lifted, the strip projects from the cap 1, a circuit, regardless of the opening between anvil and the hammer. The lever 1 circuit closer 9 are supplied with finger tips, or knobs, by which it is handled freely without danger of spring adjustable by a set screw 7, lifts the lever 1 from the anvil. The operator is about to "send," the circuit must be first pushed out from 7 so the lever when operated may open to the circuit; for it will be seen that when the lever is brought into contact with the circuit is closed at that point. It is employed at all important contacts of its durability and freedom from oxide due to the sparking which usually occurs in electric circuits are broken. The magne operated Morse keys employed in Great Britain and Europe are practically similar to shown here, but they are larger and heavier. Morse Telegraph Relay. The electromagnets which Morse first employed in telegraph weighed over 300 pounds. In 1844, however, the weight of this instrument had been reduced to 185 pounds. Within 15 years that time many improvements had been in the instrument and it then was little more than the modern (typified in Fig. 5), about three years late as 1867 relays were wound to the present standard resistance of 150 ohms. In the case of are termed "low resistance" relays the are wound to 37.5 ohms. These relays utilized in a number of instances they are employed on one circuit, the way telegraph lines and the total red resistance brought about by their are used to effect a very beneficial result in the circuits in wet and dry. The obvious explanation of this since the electric current seeks the lower the more wire circuit the less will be the current to escape by the "leaks" where foliage, trees, etc., touch the wire.

![Fig. 4 - Morse Telegraph Key.](image)

In Fig. 5, the two coils surrounding the U-shaped, soft iron cores are shown at 1, 2.
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Coils are covered by hard rubber sleeves. A mature 2 in this type of relay is a f the iron lever 9. These relays are d in two ways; either by drawing the way from the armature by means of rewear 4, or by means of the retractor 6 attached to the armature, the tension ch is variable by the windiong device 7. inding screw is movable toward or from ay coils by aid of the post 12 through the supporting piece of 7 passes in line wires are connected to the screw 8, from which small wires lead to the i. The local, or sounder, circuit wires ought to screw posts 11, 11, from posts wires lead to the armature lever to the front contact 10. The object of ay being to repeat or relay the signals on the main line to the sounder, the f the armature lever (which latter is at 3, 3'), should not be large. This is regulated by the front stop lever, the stop next the coils, and by the top screw, which is insulated.

egraph Sounder.—Many different styles tend in use. A well-known form is shown in Fig. 6. In this B, B are the

FIG. 6.—Morse Telegraph Sounder.

posts; 1 represents the electromagnet lever, pivoted on the support 4; a adjustable by the screw 5 gives the l of the lever a tendency to rest on the stop 6. Magnetism in the cores draws nature down, and with it, the lever, as stop 7 meets the metal support 8. One is designed to give resonant effects. used on primary battery circuits these 8s are wound to 4 ohms; when em- on dynamo circuits they are often to 20 and 40 ohms.

egraph Transmitters.—With the obj ect ins a simple and speedier method of ting the characters of his alphabet he manually operated key method, devised several mechanical arrange- One of these consisted of a plate of or wood on the surface of which aced in a vertical row short and long if metal, corresponding to the letters alphabet. These strips were all me r connected under the plate by a wire ed to the battery, relay and ground. e wire was connected by an insulated metal strip, or. This strips was held sand of the operator and in transmit message he would run the point of the over the metal strips representing the

given letters, thereby closing and opening the circuit, in a manner corresponding to the manual transmission of the letter. Another somewhat similar device, also due to Morse, consisted of a metal cylinder on the surface of which the characters of the Morse alphabet were arranged in a practically similar way. A keyboard was arranged over this cylinder and the depression of a key brought a metal brush into contact with the cylinder. At the same time the cylinder was caused to make a partial revolution. The characters on the cylinder being connected to the line, and the brush to the earth, the foregoing described actions resulted in the transmission of Morse characters. These transmitters did not go into wide use at that time, but within the past four or five years a keyboard transmitter, termed the “Yetman” transmitter, which is a much improved form of the Morse cylinder transmitter, has been largely adopted by telegraph operators in this country. The employment by operators of the typewriters as a means of transcribing received messages, which gave the receiving operator an advantage over the sending operator who could only send from 30 to 40 words per minute at best speed. By means of the keyboard transmitter a speed of transmission approaching the speed of transcrip- tion by the typewriter is obtained. This use of the typewriter was accompanied by a new arrangement of the sounder, which is now placed in a box, or resonator, mounted on an adjustable rod that brings the sounder in close proximity to the ear of the operator.

Lightning Arresters.—Lightning discharges tend to follow telegraph wires into cables across rivers, and into the telegraph offices, causing damage to the cables and instruments. Damage is sometimes caused also by the contact of telegraph wires with electric light and power wires. To prevent as far as possible damage from these causes, lightning arresters and fuses are placed at points just outside of cables and at points where the wires enter offices. A combination lightning arrester and

FIG. 7.—Lightning Arrester and Fuse Wire.

fuse wire is shown in Fig. 7. F is a small fuse wire carried on a strip of mica m which is tipped with metal at each end, and held by metal clips n, n'. C represents two small blocks of carbon separated by a thin layer of mica, and held in position by metal tension springs n, n. The left-hand block is connected to ground at the post G; the right-hand block is connected to the screw A from which a wire leads to the apparatus. The line wire is connected to the screw L. A strong current passing through the fine wire F will fuse it; a lightning discharge will jump to ground by way of the carbon blocks; in either case protecting the cable or instrument.

Automatic Telegraph Repeaters.—The function of a Morse automatic repeater is to take, as it were, the message from one wire
and "relay" it to another wire without the intervention of an operator. Some of the reasons that render repeaters necessary are, first, that the resistance of the wire increases directly with its length, which tends to a diminution of current strength; second, the escape of current from the line wire at points where it makes contact with trees is greater on a wire of high resistance than one of low resistance (see Relays); third, the speed of signaling decreases as the electrostatic capacity is increased and this capacity increases with the length of the wire. Hence it is found desirable in practice to limit the direct length of a telegraph circuit to a maximum of about 500 miles in this country.

The apparatus and circuits of an automatic telegraph repeater at an intermediate station are outlined theoretically in Fig. 8. This is known as the "Toye" repeater, which was at one time much in use, and is chosen for illustration because of its comparative simplicity. It may be noticed that relay $R$ controls the "continuity preserving" transmitter $T'$ by means of its armature lever $m$, and local battery $b$; while relay $R'$ controls $T'$ by means of lever $m'$ and battery $b'$. Also that transmitter $T$ controls the western main circuit at $x$; while $T'$ controls the eastern circuit at $x'$. In practice $T$ is the "opposite" transmitter to relay $R$, and $T'$ is the "opposite" transmitter to $R'$. In the operation of an automatic repeater the desideratum is automatically to keep the "opposite" transmitter passive while its circuit is being repeated into, in shop phrase. The operation of the Toye repeater is as follows: Assume that the East is sending to the West. When the eastern operator opens his key, thereby opening the eastern circuit, relay $R$ opens, as in the figure. This opens transmitter $T$, and in consequence the western circuit is opened at $x$. At the instant, however, that the western circuit is opened at $x$, the circuit which includes the relay $R'$ and main battery $M'$ is closed via the lever of $T$, through a resistance $Rh$ equal to that of the eastern circuit. As this transposition or substitution of circuits maintains the current passing through relay $R'$ at the same strength as before the change of circuits was made that relay, and, consequently, the transmitter $T'$ remains closed. In this way the "opposite" transmitter is automatically kept passive. When the eastern operator again closes his key, relay $R$, and in turn $T$, are likewise closed, resulting in the closing of the western circuit at $x$. When the West sends to the East the description is reversed.

Among the other automatic repeaters in use may be mentioned, the Neilton, the Weiny, the Mayer-Atkinson, the Ghegan and the Var.

Automatic Telegraph Systems. Automatic telegraphy consists of apparatus whereby Morse characters are sent at a rate of speed ranging from 2,000 to 3,000 words per minute. As speed of hand transmission of Morse characters is from, say, 15 to 40 words per minute it is obvious that by the use of a telegraph system many more messages can be transmitted over one wire in the same time than by the manual method; and the cost of construction and maintenance of the wires is a large portion of the expense of the telegraph equipment. If every advantage is equally weighed, the advantage would be on the side of the automatic systems. But, unfortunately, everything else is not the same. In the first place, every automatic Morse system has to be prepared for transmission by the type of the machine, and every message has to be transcribed manually before it is delivered to the addressee. This involves a larger labor in the making of operators than is necessary in the manual transmission of messages. In the second place, the number of messages manually transmitted is also greater delay in the handling of messages by reason of the address of the addressee. There is for the same reason less liability to errors by automatic transmission than by manual transmission. Nevertheless, certain automatic systems, like the Wheatstone, for instance, are found of much utility.

There are two general types of telegraph systems, namely, telegraphic and ink recording, or electromechanical systems. The former relates to recording the electrochemical action produced by the recorder, the latter to recording the sensory impulses. The chemical telegraph is usually prepared in the form of a strip of paper, hole corresponding to the character of the Morse alphabet, is then drawn over a metal roller rests a steel needle or brush; the metal roller being made a part of the circuit on which there is a primary battery or an electrochemical source. A strip of paper is drawn along the needle, which drops into the holes in the paper and contacts with the roller and completes the circuit. In this way current pulsations in duration to dots and dashes are made through the wire. At the receiving station, practically the same arrangement is made, but the perforated paper is not used. Instead, a strip of paper that has been coated with chemical solution is drawn over the roller.
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Wheatstone Automatic Telegraph — This recording system. Its apparatus con-
forming machine by which mes-
prepared for transmission; a trans-
mitter utilizes the perforated paper to
messages thus prepared, and a re-
d, being actuated by the electrical
set up by the transmitter, records
ke, on stiff paper tape, as dots and
perforator consists of small hol-
ers with keen edges, driven by the pressure
which the paper to be perforated is
pass. Three discs, connected with
orders and representing the dot, dash
are depressed by the stroke of a
the hands of an operator, with
that holes of a certain order are
the paper. Thus when the dot
pressed, three vertical holes are cut;
dash disc is depressed two vertical
horizontal holes are cut, and the then
disc is depressed one central hole is
ly as shown at the left of Fig. 9.
mitter in its operation takes the
he operator's hand and formulates
shakes with an accuracy superior to
peed 10 to 15 times greater than the
operator can attain. That por-
an transmitting signals is outlined in
L L are vertical rods attached at
tips to crank-levers A' A, respec-
tively, means of adjusting screws F, F, L'
the left of L a distance equal to the
ween any two horizontal central
ie paper. The crank-levers are pro-
ed D of M; the line wire to the upper end P';
D and P' being insulated from one another.
The lever M is really a pole-changing key
and the rods and levers simply displace
the operator's fingers, causing that key to reverse
the poles of the battery. In the present po-
ition of M in the figure the negative pole of
the battery is placed to the line. The per-
forated paper is shown by a single line and
the rod L has passed through a hole in
the paper. A revolving star-wheel H' is made
with the central rows of holes in the paper
and draws it along at a uniform rate of speed.
Assuming there is another hole in the paper
immediately opposite that one through which
L has just passed, when the lever L' moves
upward it will pass through that hole, the
paper having been moved forward by the
star-wheel just enough to bring the hole op-
posite L'. At the same time, by the down-
ward motion of L the collet C has been
withdrawn, giving collet C' on H' free scope to
push D against its right contact, 4, and P'
against the contact 1 which it will be seen
reverses the polarity of the battery to line.
If a succession of dot holes were punched
on the paper, a succession of short, direct
and negative currents would pass over the
line. When, however, a set of diagonal holes,
as at Y in Fig. 9, is punched on the paper,
the result is different, for at the first upward
movement of L it will pass through the hole,
pushing end P' of M to the right, but at the
following upward movement of L' it meets the
paper at a point opposite the hole through
which L had just passed and its further up-
ward motion is arrested. Hence M is not
pushed over and the battery is not reversed.
At the next upward movement of L its motion
is similarly arrested and the polarity of
the battery is still unchanged, until at the next
upward movement of L' it comes opposite and
passes through the hole M, causing the collet
C' to push D against contact 4, thereby revers-
ing the poles of the battery to line. This delay
in the reversal of the battery is sufficient to
make an appreciable difference in the length of the
signal recorded, and constitutes a dash.
The effect of these different actions is that,
depending on the position of the perforations
in the paper strip, dots and dashes are trans-
mitted by the pole-changer M.

The Wheatstone automatic receiver, or ink
recorder, consists of a polarized relay (see
Polar Duplex in this article), the armature
lever of which is extended at a right angle at
its upper end, and this extension at certain
times is caused to impinge against a light rod
pivoted at one end. On the end of this rod
is a small circular disc, the lower portion
of whose periphery is immersed in an ink well;
an upper portion of its periphery is placed
very near the stiff paper tape previously
mentioned. The axle of this disc is given a slight
tension away from the paper. When, however,
a current of positive polarity, designed to re-
cord a dot or dash on the paper, actuates the
polarized relay, its extended armature lever
presses against the axle of the disc causing it
to deposit a mark on the moving paper tape.
A negative current causes the withdrawal of
the disc from the paper. The positive current
in this system is termed a "marking" current;
the negative current a "spacing" current, when
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It is operated by the "double current" or reversal of polarity method; to which further reference will be made in connection with Duplex Telegraphy, also in this article. The circular disc is kept in rotation by a simple clockwork mechanism and thus constantly renewal its supply of ink. The paper strip is drawn forward at a desired rate by rollers operated by mechanism within the box.

The Wheatstone automatic telegraph may be worked duplex by using a differentially wound relay and the other necessary apparatus of a duplex system. When worked as a duplex it gives a wire of moderate length, in which there are no very long submarine or underground cables, a capacity of from 200 to 350 words in each direction. On a 1,000-mile duplex circuit, such as from New York to Chicago, with one repeater station at Buffalo, a speed of about 125 words per minute in each direction is now obtainable.

Writing Telegraph Systems.—Writing or automatic telegraph systems transmit and record facsimiles of letters or characters while they are being formed by the stylus or pen in the hand of the operator. The first to produce a writing telegraph system was probably Mr. A. E. Cowper, of England, who employed in the operation of his system the principle of the parallelogram of forces, whereby by compounding the movements of a point in two directions, the one at an angle to the other, the actual movement of the point is the resultant of the two movements. The Telautograph (g.v.) also operates on this principle. In the Cowper system the receiving pen depends for its movements upon variations of the magnetism of two electromagnets placed at right angles to one another, which variations produce changes in their magnetic fields, to which changes an armature carrying the receiving pen is free to respond. The magnets are placed in separate circuits. The variations in the magnetic strength of the magnets are caused by variations of the current strength in their circuits, which variations are brought about by means of a pencil which when moved by the operator in the act of writing is caused to switch resistance coils in and out of the respective circuits.

Duplex Telegraphy.—This consists in the sending of two messages over one wire, in opposite directions at the same time. Since on an ordinary Morse telegraph circuit it is not possible to send more than one message at a time over a wire, it is essential, in order to make duplex telegraphy possible, that the signals transmitted from the sending station shall not interfere with the signals to be received at that station. The receiving instruments must, therefore, be so constructed or placed that while ready to respond to all signals from the distant station they shall not respond to signals from the near or home station. These requirements are met in two ways in practice: one method being known as the "differential," the other as the "bridge" method.

The differential plan is used almost exclusively on land line duplex telegraphy; the bridge plan is used in submarine cable telegraphy. The "differential" plan avails of the fact that if a soft iron bar or core, B

wires 1 and 2 remain as before, but the bar H is now connected between them as wound with but one coil. a', b' are coil resistance, termed the arms of the i (Wheatstone bridge). Assuming the n of wires a', b' and wires 1 and 2 to be the electric pressure due to battery b, terminals of the bridge wire, will be opposite, and hence no current will the bridge wire.

There are two systems of duplex telegraphy in use in this country and in England, namely, the "Stearns" duplex and the "Wheatstone" duplex, and these combined comprise the "Quadraplex," described later.

The Stearns Duplex.—The Stearns duplex is operated by increment and decrement of current on the line, virtually as in a Morse system is operated, namely, bringing a current over the line to act as a distant relay, which attracts its armature by removing the current from the near station. The Stearns duplex may also be considered as a land line duplex, except that instead of a single submarine cable, there is a pair of cables. The "differential" plan avails of the fact that if a soft iron bar or core, B

the iron bar, and as each current up opposite magnetic poles in the coil the current will neutralize the other and no effect will be produced in the wire 1 at its distant or right-hand end, a amount of current will flow in coil 1 and in consequence the core magnetized to a degree depending on the strength of currents on the respective coils; hence the term "differential" and a relay wound in this way is a differential relay. The theory of the "differential" plan is outlined in Fig. 11. The battery,
The stearns duplex is shown in Fig. 12, represents the apparatus at two stations $A$ and $B$. The relays $M, M'$ are wound on coils in opposite directions around $D$; one of the coils of each relay being $l$ to the main line and the other to a resistance coils, $R, R', K$ and $K'$ for the purpose of making the circuit complete and to act as keying keys. When key $K$ is closed, positive electromotive force is applied to the key $K'$ and closed so as to make a negative force to the line. When the line wire is placed to $B$, since the battery current will divide the two coils of the relay in the resistance of the circuits to each coil, a means must be provided to make those circuits of equal resistance in order that unequal currents will flow in the resistances and the relays will be operated. It is the function of the rheostats $R$ to provide a resistance that of the main line and the main resistance, of the distant relay, so that there will be a balance. In the figure, key $K$ and $K'$ open, a current flows in the line from $A$ to $B$. As currents are flowing in opposite directions through the core of relay $M$, its armature is attracted. On the other hand, as there is a path for the current from $B$ to earth, back contact of key $K'$, no current will flow through coil 2 of relay $M'$. Hence, the core of $M'$ is magnetized.

Fig. 12.—Theory of Stearns Duplex.

It acts its armature $a'$ as shown. If $K'$ should be closed this would add negative polarity to the main line making 200 volts on the main line, would place only 100 volts to the artificial coil at $B$. Hence double the amount it flows in the line coils 1 of each of the other coil, the line flows through the artificial line coil. Thus the armature $a'$ of $M'$ is now and armature $a$ of $M$ continues to act as current to $B$.

Polar Duplex.—This system also employs wound relay, transmitting main and artificial lines similar to the Stearns duplex and for the same but the type of transmitting keys and different in the two systems. Relay employed in this system is termed the relay $E, E'$, Fig. 13) and is based upon the principle, that unlike magnetic poles attract each other and that the pole of one bar in contact, say its north pole $N$, be so pivoted that it will move freely toward the south pole of an electromagnet $E$; it will follow that by changing the direction of the current flowing in the coils of the electromagnet, the permanent magnet $a$, which will oscillate between the poles, will be caused to follow the changes of polarity in the electromagnet. If the permanent magnet $a$, which is virtually the armature of a polarized relay, be given control of a local circuit containing a sounder $D$ and battery $b$, it may be caused to record signals in a manner practically similar to that in which the Stearns' relay records them. It is only necessary to provide a pole-changing key $F$ to reverse the direction of the current flowing in the line, to bring about this result. Fig. 13 represents in theory the circuit and apparatus of a differential polar duplex; the apparatus and arrangement of circuits at the terminal stations $A$ and $B$ being indicated. When the pole-changer $F$ is closed, the current flows to $B$. As current flows to the line and the direction of the current is as indicated by the arrows. When the key $F'$ at $B$ is closed, a negative pole of a battery is placed to the line. In these positions of the keys the direction of the currents in the main and artificial lines is as shown by the arrows, and the relays at both ends of the line are recording a signal, the sounders being attracted. This is due to the fact that an excess of current is flowing in the line coils at $B$ in a direction to produce magnetic poles in the cores of the relays as marked. If now, for instance, the key $F'$ at $B$ should be opened the effect would be to place a positive pole of the battery to the line. The effect of this is that each end of the main line is placed at equal and like potentials, and hence no current flows over the main line or in the main line coils of the relay. A positive current from the battery at $A$ with a strength of say 1 will still flow through artificial line coil at $A$, but in a direction which will reverse the previous polarity of the core; consequently the armature of the relay is attracted to the left side and the local circuit of sounder $D$ is opened. An examination of the conditions will show in every case that when the pole-changer at either end is opened or closed, the local circuits controlled by the armature of the distant relays will also be "opened" or "closed." From which it follows that dots and dashes may be transmitted from both ends of the line simultaneously by a proper manipulation of the pole changers.

The instrument $C$ shown at $A$ and $B$ is an electrical condenser. It performs a very
useful function in duplex and quadruplex telegraphy as follows. The artificial line coils $R K$ which are used to "balance" with are usually composed of spoons of fine German silver wire, wound double, or non-inductively, so that they may not possess any perceptible magnetic effect or inductance. These coils have no static capacity. The main line it is known does possess static capacity. Hence at the moment of charging and discharging the line there is a momentary inrush and outrush of current into and from the line greater than that due to the ohmic resistance of the line. This would produce a momentary inequality in the current in the coils of the relays unless equal capacity were given to the artificial line. This is done by adding the condensers $C C'$ to the artificial line. These condensers are adjustable and by means of metal plugs more or less capacity may be added until a static balance is obtained. The rheostats are also adjustable in order that the resistance balance may be readily obtained.

The Quadruplex (Edison).—The Stearns duplex depends for its operation upon the increase or decrease of the strength of current on the line, regardless of the direction (polarity) of the current, whilst the polar duplex depends upon changes in the direction of the current regardless of current strength. In the operation of the Edison quadruplex system both of these principles are combined on one wire; the instruments used being the transmitting key (transmitter) and Morse relay (the neutral relay) of the Stearns duplex, and the pole-changer and polarized relay of the polar duplex.

The relays are wound differentially for the purpose stated previously and rheostats, condensers, etc., are employed, as in the duplex systems described. In the Stearns duplex, when the transmitter is open there is no electromotive force to the line, the wire in that case being placed directly to ground. Since the polar duplex depends for its operation upon the reversal of polarity, provision is made for this requirement in the quadruplex by so arranging the connections of the transmitter $K$ that when the latter is "open" a small portion, 1, of battery $B$ is left in the circuit to be opposed to the pole-changer $P C$. When $K$ is closed, the full battery $B$ is reversed by the pole-changer. On the other hand, when the small portion 1 of battery $B$ is to the line, and only a weak current is traversing the line, the adjustment of the retractile spring is such that the armature $A$ is withdrawn from the core; while, when the key $K$ is closed, and the full strength of battery passes to line, the armature is attracted. Both stations are equipped. Thus an operator may read, t and the consequent increase and decrease the current strength will operate the neutral relay $N$. But the operation of a will not practically affect the distant relay $P$ inasmuch as the armature is caused to change the direction of current on the line. On the other hand the pole-changer $P C$ will operate the distant neutral relay. Thus two signals may be sent in opposite directions at once over a quadruplex circuit; this system, therefore, giving the equivalent of four wires. The three wires thus gained are "phantom" wires.

Many details of apparatus require practice are, for lack of space, omitted, but complete details of these systems are given in the author's "American Telegraphy" Encyclopedia of the Telegraph; from work a number of the diagrams used in this article are reproduced with the consent of the publishers.

Submarine Cable Telegraphy.—The strength of signaling through an electrical circuit is inversely proportional to the product of the electrostatic capacity and resistance of a conductor line directly with its length. The capacity varies with the material comprising the conducting medium (see ELECTRIC CONDUCTORS). The high electrostatic capacity and the length of submarine cables conduct to the danger of signaling. When a long cable is connected with a source of electromotive force the discharge is communicated to the distant end almost immediately, but the amount of charge at arriving is extremely small and the current current rises slowly thereafter to its maximum. The discharge is approximately as great as the charge. Hence a desideratum in submarine telegraphy is a receiving instrument that will respond to a very feeble current. A weaker the current required the shorter the time of charging and discharging the and the more rapid will be the rate of signaling. The first successful receiving instrument devised for this work was a mirror galvanometer (see ELECTRIC MIRRORS). The light from a lamp is thrown to a mirror and the light is reflected back to a screen. The mirror is carried on a system including several very small needles, which are in the centre of a fine wire, the coil being in the circuit. Minute pulsations of current or needles to be deflected to the right or left, according to the direction of the currents, causes the spot of light on the screen to be focused to the right or left. A deflection right constitutes a dash, one to the left. The direction of the deflections is reversed by means of a special form of key (K), Fig., a positive and negative currents may be transmitted. The mirror receiver gives no indication of the message, the signals being written by the operator as they are received.

A later invention, the Siphon recorder, due to Sir Wm. Thomson (Lord Kelvin) comes to notice this objection. This instrument.
Fig. 15, consists of a coil of fine copper which is suspended between the poles of a powerful magnet, \( M \), in such a manner that, when a current passes through the coil, it sets itself at right angles to the lines of the magnetic field. When no current is flowing in the coil, two small weights, placed at the lower end of the coil, in the plane of the magnetic lines of the magnet, A, make it possible for the coil to remain stationary. A siphon, \( C \), consisting of a small glass tube is attached to the coil wire. The lower and bent end of the siphon is placed directly over the centre, or eye, of a paper ribbon, \( P \). The pole-changing key, \( K \), sets up momentary elastic tension of the diaphragm, and produces the diaphragm of the telephone, and the sound produced is transmitted into the telephone. The key, \( K \), is made of a light, flexible material, such as rubber, and is moved by a light spring, \( S \), which is attached to the key and maintains it in a neutral position. When the key is moved, the spring is compressed, and the diaphragm is displaced, producing the sound.

Simultaneous Telegraphy and Telephony.

This is sometimes erroneously termed "composite telegraphy." The art relates to telegraphing and telephoning over one wire at the same time.

When a telephone receiver is inserted in an ordinary telegraph circuit, the operation of the Morse keys deflects the diaphragm abruptly and produces loud noises in the telephone, which render the reception of speech nearly impossible. Van Rysselberghe, of Belgium, discovered that if the rise and fall of the telegraph currents were made gradual, no disturbing sounds would be heard in the telephone. To bring about this result he introduced into the telegraph circuit a combination of electromagnets and condensers, which by retarding the rise and prolonging the fall of the telegraph currents merely inhibit the diaphragm of the telephone, but do not produce any sound thereby. When this result is obtained the telephone currents may then be superposed upon the telegraph currents without impairing the efficiency of the telegraph signals. Simultaneous telegraphy and telephony is now in successful use in the United States on a large scale; two telegraph circuits are being operated as one telephone metallic (two wire) circuit, on circuits up to 400 miles in length.

Synchronous Multiplex Telegraphy.

It is known that 500 pulsations of electricity per second can be transmitted on an overhead wire of moderate length. A telegraph operator at his best speed is not capable of transmitting more than an average of 10 dots per second. Hence it was thought that if means could be devised whereby a number of operators should consecutively be given exclusive control of a wire for brief intervals of time the same wire might be utilized to transmit four, six or more messages at practically the same time. In order that this might be done satisfactorily it was evident that the corresponding transmitting and receiving instruments at the near and distant stations should be placed in connection with the wire at identical instants. This entailed the construction of devices for obtaining exact synchronism; hence the name of the system.

The apparatus for obtaining synchronism and for apportioning the wire among a number of operators consists of a revolving wheel at each end of the telegraph line, the wheels revolving as nearly as possible at a uniform rate. Each wheel is driven by an electric motor whose motion is controlled by a vibrating reed at each station, which reeds are attuned to the same rate of vibration, as closely as possible. This wheel is supported on a vertical shaft. Below it is a stationary circular disc made up chiefly of a large number of metal
segments (84) radiating from near the centre of the disc, and insulated from one another by suitable material. The shaft supporting the wheel passes through the centre of the disc. The shaft carries by a suitable projection a brush or trailer, which, as the wheel revolves, is swept over the segments in rapid succession. As the trailer makes three revolutions per second, it passes over each segment three times per second. If it is desired to transmit six messages at once, 72 segments are set apart for the purpose, and each of six desks at each end of the wire are allotted 12 segments. That is, starting from any given point on the disc, the first segment will be given to desk No. 1; the second segment to desk No. 2, and so on to the sixth segment, where two segments are skipped, being reserved for synchronizing purposes. A second series of six segments is then connected to desks Nos. 1, 2, 3, and so on around the disc. The line wire is connected to the shaft or trailer of the revolving wheel at each station, and, consequently, as the trailer makes three revolutions per second, the disc is in contact with the line, and with its corresponding desk at the distant station, 36 times per second. As an operator cannot make a dot in less than the one-twelfth of a second it follows that in that time the trailer will have given him contact with the line twice. Hence each one of six operators may transmit messages as though he had entire control of the line. As each character received at any one desk is caused by a drum to make motions an arrangement of relays with a contact on the "lack-stop" is employed which delivers the signals virtually unbroken at the receiving end. Synchronization is maintained by means of the two segments referred to which send "correction" impulsus that retard or accelerate the speed of the wheel that carries the trailer.

Dial Telegraph.—Various known as dial, A, B, C, and pointer telegraph system; due to Breguet, Kramer, Frischen, Wheatstone and Siemens. The systems employ a dial carrying on an outer circle the letters of the alphabet and on an inner circle figures and punctuation marks. A pointer operated by suitable mechanism within a case moves like the minute hand of a clock around the dial in response to pulsations of electricity from a sending instrument. The sending instrument has a similar dial and is equipped with a key which is movable around the face of the dial. As the key is thus moved it opens or closes a circuit, or it causes the movement of a magnet before coils of wire within the case, that transmits pulsations of electricity over the line, which in turn actuate, by means of an electromagnet, a cam which moves the pointer as stated. The operator moves the transmitting key uniformly around the dial. As he does so the pointer on the receiving instrument moves a corresponding distance. When the key arrives at a desired letter the operator places his finger on the point opposite the letter on the dial and thus makes the key to the next desired letter, and so on, in this manner spelling out his message. This system is slow, but it possesses the advantage of requiring little movement of the operator. Hence, especially before the days of the telephone it was in favor as a means of communication between police fire headquarters, on railroads, etc. As where stated telegraphs of this order are in use in other countries.

Military and Naval Telegraph.—Telegraphy is quite extensively employed in army and navy of this and other o. The distance covered by any variations is about 25 miles. Signals are transmitted by reflections of the rays of the reflection and the duration of the reflections being correspond to dots and dashes of or any other preassumed code. One heliograph consists of a mirror in a socket and supported on the end of a tripod. The reflections are in the direction of the distant station signals are sent by interposing the hand screen before the mirror. When the not in a suitable position to admit of its reflection in a desired direction, two are employed, one facing the sun, which reflects the sun's rays upon the mirror facing distant station.

Flag-signaling, termed wig-wagging, flash signaling by lanterns and search, also by horns, whistles and sirens are employed by the various armies and navies 0. world. Also Morse telegraphy and wire telegraphy (q.v.). Torches at night take the place of the flag in signaling. In flag and signaling, as well as in heliography and signaling the Continental Morse alphabet is now used. Arbitrary characters of this system have been standardized in telegraph systems in which a deflection to the left is represented by the figure "1"; a deflection to the right by the figure "3." Thus A is represented by "3" in one such alphabet.

In wig-wagging or torch signaling the man faces exactly toward the distant staff is vertical in front of centre of b at height of waist. When the Morse is employed, a dot is represented by a of flag or torch and a dash by the left; the space by a "front" motion.

SEMIPHORE

Printing Telegraph, Stock T

Printing telegraphy relates to those systems in which telegrams are printed received on strips or sheets of paper. Gem speaking, printing telegraph systems of stock ticker type depend for their operation upon the synchronous rotation of a cylinder at a receiving station with a wheel at a sending station. If, for two wheels of equal size having peripheries type letters of the placed side by side and are caused to rotate at a constant synchronous rotation of two or such wheels or cyzitwheels, it is obvious that if it they start with a letter at a given point, each wheel will present a similar letter at the given time as long as the wheels rotate at equal speed. However, a difficult matter to obtain uniform synchronous rotation of two or such wheels or cyzitwheels, which are revolving at a high rate of speed, their movements are under control of master wheel or transmitter. On account of this, the control of electrical printing telegraphy, consists in the well-known "ticker" by type-wheels of the tickers in the various
TELEGRAPH

Under control of a transmitter which
s them in synchronism by a "step-by-
vement, so called. In certain other
telegraph systems, such as the Hughes,
used in Europe, the uniform rotation
transmitting and receiving wheels is
ed by a nearly synchronous rotation of
rs at each end of the circuit, and, in
by a "correcting" device applied to

Assuming that the wheel \( W \) sends out 32
electrical pulsations in one revolution these
pulsations will cause one revolution of the
type-wheel. Thus, if the transmitter be set
in motion with brush \( B \) resting on the seg-
ment that is in line with, say, the pin under
key \( A \); while the letter \( A \) on the type-wheel
is opposite the platen \( P \) on the end of the
lever of the press-magnet, it follows that for
every revolution, or part of a revolution, of
the cylinder just enough pulsations will be
transmitted to cause the type-wheel to pre-
sent a letter opposite the platen corresponding
to the key depressed. If the transmitter and

type-wheel do not start with corresponding
letters in the required position misprints fol-
low. This is obviated by having the appar-
atus to a "unison" point after a few re-
volutions of the cylinder. The speed of
rotation of this apparatus is about 120 re-
volutions per minute.

The apparatus shown prints letters only.
When figures are to be printed, a figure wheel
is placed on the shaft, side by side with the
letter wheel, and a "shifting" device is em-
ployed which shifts the letter or figure wheel
under the printing platen when a letter or
figure is to be printed. Usually two wires are
employed in the latter case, one to operate the
"shift" apparatus.

In printing telegraph systems of the kind
just mentioned, considerable loss of time en-
sues from the fact that frequently it is neces-
sary to rotate the type-wheel the greater part
of a revolution in order to print one letter. Thus,
if the letter \( A \) follows \( B \) in a given word, it
will require 31 pulsations of current to print \( A \),
assuming that there are 32 letters and punctu-
ation marks on the type-wheel. If \( R \) follows \( C \),
15 pulsations will be necessary. This conduces
to a low rate of speed, perhaps an average of
30 to 40 words per minute; the message being
printed on a paper strip.

Hughes' Printing Telegraph.—An under-
standing of the operation of this system may
be gathered in a general way from the im-
mediately preceding remarks. It is not, how-
ever, a step-by-step system, but depends for its
operation on the synchronus rotation of two
wheels, one at each end. When a key of the
keyboard is depressed at the sending station it
catches a pin on a rotating wheel, or chariot,
but does not stop the wheel. The pin so caught,
however, at that instant causes the transmission
of an electric current over the line. This
pulsation in turn instantly operates an elec-
 tromagnet at the receiving end which trips a
device that throws the paper strip against the
letter on a type-wheel which at that moment is
in the printing position, and, assuming the
transmitting and receiving apparatus to be in
synchronism, a letter corresponding to the key
depressed will be printed at the receiving
station. The synchronous rotation of the
wheels is obtained primarily by means of a
pendulum at each station which is adjusted and
arranged to ensure a proximate rate of rotation
TELEGRAPHY

to the respective wheels, but as the pendulums alone cannot be depended upon to maintain proper synchronism, a cam arrangement is provided which, every time a letter is printed, moves into a receptacle on the edge of the printing wheel and corrects the synchronism of the wheel, putting the wheel slightly forward or backward, as may be necessary. Pulsations of current are thus only transmitted over the line when a letter is being printed.

Buckingham Page Printer.—To avoid the loss of time due to the rotation of a single type-wheel with many characters the Buckingham printer (in one of its forms) employs four very small octagonal type-wheels mounted side by side on one shaft. On the periphery of each wheel eight letters and other characters are placed, 32 all in all. The shaft on which these type-wheels are mounted is so arranged that by an ingenious disposition of five electro-mechanically operated levers, it may be given both a lateral and a rotary motion such that any one of the 32 characters on the type-wheels may be placed before a given point for printing, by five pulsations of current. The selection and printing of any letter or punctuation mark are brought about by a cycle of six pulsations of current in all—that is, three alternations of polarity. These pulsations are of varying length, akin in this respect to the Morse alphabet. For example, the letter A will be selected by a dash, short space, dot, short space; dot; B by a dot, long space, dash, long space, dot, dots and dashes being made by positive currents, spaces by negative currents, as in the Wheatstone automatic telegraph (q.v.). The combinations of dots, dashes and spaces representing the different letters comprise what is known as the Buckingham alphabet. For the actual printing of a character, the sixth pulse, corresponding to the space between letters and words in the Morse and Wheatstone systems, is utilized. This is always a negative pulsation. In the preparation of messages for transmission, and in the actual transmission of messages, this system is the same as the Wheatstone automatic telegraph, and if the Wheatstone receiver were employed, the messages would be received as dots, dashes and spaces.

The transmission of the six pulses of alternating polarity of the letter of the Buckingham alphabet operates a polarized relay in the receiver at the receiving station, which relay by its armature controls two circuits, in which are a governing relay, a magnet and an escapement magnet. Imparting, by means of an escapement and step-by-step motion to the sunflower disk of peculiar construction, to such purpose with the co-operation of the governing and depending on the duration of the pulses and the order of their arrival, more selecting relays are operated, and in turn, cause the operation of the type-levers which bring a desired letter on the wheel to the printing position. Hence Buckingham printer is a positive or step system in which an escape-wheel with it the sunflower, is caused by a few six pulses of current, one or more of which are prolonged, to undergo a cycle of six for each letter or character selected and p

Consultant author's 'American Telegraph Encyclopedia of the Telegraph' for d

The Barclay Page Printer.—This is a modification of the Buckingham printer just briefly described. The operation of the Barclay printer is somewhat similar. In this system, all relays is virtually similar to that of Buckingham. At this point, in the Barclay, the selecting relays, instead of operating the type-wheel shaft, are caused to select one of 30 or 32 electromagnets, which controls or operates a certain typewriter which prints the letter, the being printed by the typewriter in any way, by the aid of electrical devices. May be transmitted by this system by a keyboard manipulated by an operator by means of perforated paper.

Murray Page Printer.—This printer being used on the lines of the British office. The messages to be transmitted prepared somewhat as in the case of method utilized in the Wheatstone au system. The perforated paper sends combinations of electrical pulsations for given letter over a main line and these letters in turn operate apparatus at the receiving station which perforates a paper a manner corresponding to the letters transmitted. This paper is then caused to form a set of metal strips which operation, and depending on the combination of perforations in the paper, select a letter of a typewriter, the message thereby printed in page form. This system is about 103 words per minute. C

Trans. Am. Inst. El. Engin. 18 at the using station apparatus in a local at the receiving station. The speed of the system is about 103 words per minute.

Baudot Multiple Printer.—This is in successful operation on many of graph lines of the French government. Its multiplex feature it employs differently similar to the described herein to Synchronous Multiple. To keyboard is used, and letters are by depressing a given key which sends necessary combination of pulsations to show a given letter at the receiving end. A suitable selecting relay is the given selected and printed. The rate of s
TELEGRAPHY

is about 120 words per minute on t. Consult Thomas' 'Traité de
que Electrique'; also Electrical Re-
York, 12 April 1899.

tuplex Printing Telegraph System.
country and in Great Britain a suc-
ting telegraph system based largely
odot and Murray systems has been
veloped and by means of which eight
ssages are sent on one wire simul-
t a rate of 40 and 30 words respec-
tively.

description of this system may be
. In one respect it resembles the
multiplex system previously de-
ein.
employs a number of insulated seg-
gged circularly at each end of the
over which a revolving brush or
used to pass. Instead of attach-
y and relay to alternate segments of
r disc, however, each of five com-
ts of such a disc are connected
small square with a key. Each key is
source of electromotive force,
e receiving end of the circuit each
responding consecutive segments of
 disc or ring is connected with a
re are four series of such consecu-
tected keys and relays on the seg-
gs. One or more of each series of
depressed to form a certain com-
f of electric impulses representing a
, which impulses are transmitted by
over the circuit and in turn these
erate a corresponding series of re-
ceiving station. These relays by
ure operate mechanism whereby a
 en letter is selected and printed in

As there are four series of keys
connected to the segmental discs it
that four letters of four different
or messages may be transmitted at
 of the trailer around the disc.
transmission of words was based
the speed of rotation of the trailers,
 turn is largely controlled by the
and electrical limitations of the
and line. In the Baudot system a
 s to transmit a predetermined
 of electric impulses to form a
xplex printing telegraph sys-
termed the multiplex printer the paper per
keyboard perforator manipulated
or at a speed slightly greater than
automatically transmitter of the printer,
pear prepared is fed directly
an perforating machine into the said

The foregoing arrangement
els are provided on one wire and
plexed in the manner described
nection with the Morse duplex sys-
tem of each letter as a separate
. As each channel may be operated
of 40 words per minute a total of
per minute is thus obtainable in
long circuits, the messages being
Romney letters in narrow telegraph
age form. Means are provided for

the maintenance of exact synchronism between
the transmitting and receiving trailers over
their respective segmental discs — analogously
as in the synchronous multiplex Morse system,
but greater refinement of apparatus and oper-
ation is necessary in the multiplex printer.
Obviously this must be so from the fact that
in the multiplex printer means are provided
for operating the typewriter carriage, printing
the letters, etc.

The code or alphabet employed in this
multiplex printing telegraph system is virtually
similar to the Baudot alphabet. It is known
as a five equal unit alphabet, that is, five im-
pulses of positive or negative current are com-
bined to form a given letter. Thus the letter
A is assigned two positive and three negative
impulses, B one positive, two negative and two
positive units. Each current impulse in the
Baudot code is of equal length and by different
combinations of the five impulses it is possible
to form 31 letters or characters. In the Morse
code the dots and dashes lengths and figures are of varying lengths, and hence
a letter of the Morse code may consist of from
1 to 12 units. The average number of units in
a letter of the continental Morse code is prac-
tically nine units per letter. It has been cal-
culated that this disparity in the two codes
results in an advantage for the Baudot alphabet
in practice of about 65 per cent over the Con-
tinental Morse alphabet in the rate of transmis-
sion over circuits of equal length.

This multiplex printer rendered most efficient
service in France under the direction of the
United States Signal Corps.

Miscellaneous Telegraph Systems.— In ad-
dition to the telegraph systems referred to
herein, many others have been in actual op-
eration during the past century, either ex-
perimentally or commercially, among which
may be mentioned the electrostatic systems
of Compton, Reuss, Reizen, Don Silva, Be-
tancourt, Cavallo; Ronald's synchronous
system; the electrolytic systems of Sorensen
and Coxe; the chemical facsimile systems of
Cassell, Bakewell, Denison and Bonelli's chemi-
ical printer; the chemical dot and dash systems
of Bain, Morse, Anderson, Delany, Dyar;
the electromagnetic systems of Alexander, Gauss
and Weber, Steinheil, Scherzer; the novelty
systems of Wheatstone and Cooke, Davy; the
dial systems of Siemens, Breguet, Kramer;
the printers of House, Hughes, Phelps; the
Meyer multiplex; the Mercader multiplex and
the Altemeker mechanical automatic system.

Telegraph Systems in Practical Opera-
tion.— Wherever the electric telegraph is em-
ployed the Morse system is the one most
generally utilized. In some countries such as
the United States and Canada, Sweden, Portugal,
Switzerland, Egypt, Bulgaria, New Zealand,
India, Australia and South America, the Morse
system is used almost exclusively. In Great
Britain, Italy, Russia, France, China, Japan, the
Morse and the Wheatstone automatic, which is
simply a fast Morse system, are in common
use. In Austria, Belgium, Great Britain, Hungary,
Sweden, Russia, France, the Hughes printer is
in extensive use. In France the Baudot printer
is utilized; also in Italy, Holland and Switzer-
land to a limited extent. In Great Britain,
about 750 Morse ink recorders; 925 Bright's
Bell; 5,000 A B C telegraph, 30 Delany multiplex; and 4,700 single needle apparatus are in operation. All told there are approximately 70,000 Morse sets in operation in the United States alone, 27,045,000 in all other parts of the world. There are in Europe about 1,700 Hughes apparatus; and in Europe and elsewhere about 530 Wheatstone automatic sets in operation. Needle systems; A B C and Bell apparatus are quite largely used in Europe on the railroad and commercial telegraph lines. A page printing telegraph system, termed Morkrum Printer, is also in extensive use in the United States.

It may be remarked that there is a desire on the part of the telegraphing public in all countries to receive telegrams in type and in page form, and as far as practicable the various telegraph administrations are endeavoring to comply therewith. In the United States, as already intimated, the Morse operators in numerous instances transcribe messages by the typewriter as received. In Great Britain the Murray page printer has been adopted by the government, and in Europe generally, where messages are received on paper strips as by the Hughes and Baudot systems, the strips are pasted on blanks in page form for delivery.

Speed of Different Systems.—The average speed of transmission by the Morse manual telegraph may be placed at about 20 to 25 words per minute, although skilful operators attain a speed of 45 and 50 words per minute. The speed by the Wheatstone system on short lines is about 500 to 600 words per minute. By the Hughes an average of about 30 words per minute in one direction is obtained. This system may be duplexed, giving 50 words per minute on one wire. By the Baudot system, operating as a quadruplex, 120 words per minute; as a sextuplex, 180 words per minute. By the Buckingham and the Barclay systems a speed of 80 words per minute, in each direction, may be obtained on circuits from New York to Chicago, with repeaters midway. By the Murray paper, about 30 to 100 words per minute in each direction may be obtained.

Mileage of Telegraph Lines, Wires and Submarine Cables.—In the United States the total amount of pole lines is about 238,000 miles, on which about 1,700,000 miles of copper and iron wire are excited. In Canada there are about 35,000 miles of lines and 84,500 miles of wire. In both cases the various railroad companies also operate a considerable amount of telegraph line (about 250,000 miles of wire) for the movement of trains, etc. In all other parts of the world there are approximately 435,000 miles of telegraph pole line and 1,450,000 miles of wire, exclusive of about 48,000 miles of pole lines and 216,000 miles of wire controlled by railroads. The average size of the copper wire used on telegraph pole lines is No. 12 or 14 B. & S. gauge; that of iron wire, No. 6 or 8. The nature and size of the poles varies in different countries. Cedar is largely used in the United States and Canada; fir in Europe. Poles 30 to 40 feet long and set five feet in the earth are used. Thirty to 40 poles to the mile has been common practice, but the tendency in this country is toward the use of 45, 50 and more poles per mile to obtain greater security against sleet and wind storms.

The amount of submarine cables in parts of the world is about 200,000 miles, this cable being controlled by governments; the remains owned and operated by private companies. All there are about 1,000 submarine cable varying length in different parts of the globe. While, as stated, the telegraph system in the United States and Canada are operated by private companies, the governments of both of these countries have strung and laid for their own purposes a miles of overhead lines and submarine cables. Thus, the United States government has strung its own telegraph lines and cable Alaska and the Philippines. The A.M. lines extend from Seattle, Wash., to N. Alaska, a distance of 3,625 miles, under 1,459 miles of land lines. 2,079 miles of submarine cable and a wireless circuits of 107 miles in length. The government handles all commercial messages on these lines at a fixed charge. The Canadian government owns and operates about 17,000 miles of lines and cables. The bulletin on movements of fish in the waters of the of Saint Lawrence and other shore lines gather with messages relating to weather, antine and signal service, are transmitted by charge.

Administration of the Telegraph.—Administration of the telegraph is in the hands of the government in all parts of the world. The actual management of the telegraph systems of the various countries of the world is, of course, in the hands of the authorities of those countries, but, in general, the disposition of all matters that relate to the regulation of international telegraph are such, for instance, as the maximum number of letters that shall constitute a word, the abbreviations to be used, etc., is reposed in the hands of the International Bureau of Telegraph Administrations, Berne, Switzerland. In fact, however, even the United States and Canada are to some extent under the control of this bureau in so far as relates to the intercommunication of telegrams with countries under the jurisdiction of the bureau. Thus, if the bureau decides the maximum number of letters in a word, companies publish certain telegrams abroad as regards telegrams that may be rented for or that may be rented from wholly within the jurisdiction of the international bureau.

William M. Taylor, Author of 'American Telegraphy and Encyclopedia of the Telegraph.'

TELEGRAPHY Submarine System of communication between steamer by sound telegraph through water. In A. J. Mundy tested an experimental box Boston Harbor, based on the conductivity of sound through liquids by Elisha Gray. Experiments by J. B. proved remarkably successful. Signals exchanged between lightship bell and a seven miles distant at sea. Sound travels through water or liquids than air and is taken advantage of in a practical way.
TELEGRAPHY, WIRELESS

...at sea are two sound receivers, one ch side in the hold, located approxi-
dly 20 feet below the surface of the water. The ship has the sounding bell hung a well in the centre of the ship, about below the bottom. It also has a receive-
arrow in the rigging at the top, and the shore ty from which depends a bell, with a ding to the shore to a compressed-air r in the lighthouse. The bell is sus-
by a main chain, while a second operat-
...ted by a direct upward pull by manual t desired. It has been ascertained that iv...collecting the sound vibrations it be located on the outside of the bu...operates as well when clamped on de against the inner surface of the ill...

...owing...a...from the bell passing through the communicated to the side of the ship's l that in turn to the liquid or water in...; which is a cup-shaped metal cyling the open end clamped against the hull. Inserted in the top of the is an electric transmitter, something order of a telephone transmitter, from s are run to the pilot-house of the s the sound travels through the water direct from its source; it is found impulse will be stronger and louder side of the ship nearest to the source. means the direction of the sounding bell ained, for by listening to the telephone attached to the starboard side water and then switching over to the port listening to that telephone receiver, the cts at once which is the louder sound w... This was determined experiment-

...taining the ship around in a large circle y weather, signals of this kind are heard, regardless of which way the wind... The usefulness of the system in ding ships against collisions at sea at in a fog is evident. Simon Lake,...f the submarine boat, has experi-

EGRAPHY, Wireless. During the years attempts have been made, with less success, to avail of electromag-

...duction for signaling to a distance wires, by means of what have been induction telegraph systems. Such employ in their operation the well-principle that when an electric current or falling in one wire will develop a current in a neighboring parallel helps and Edison have employed this in signaling to and from moving These systems were in operation for on several railroads in this country. e...even though there was for lack of e. Preece also, in Great Britain, de-

...ral miles in length is strung on poles e. coast of the mainland, a parallel wire being erected on poles along the shore of an island. These wires are placed in the earth, or "grounded," at their respective terminals. By employing a battery, an induction coil and a Morse telegraph key in one of the wires, and a telephone receiver in the other, it is feasible to transmit signals by induction (pos-

...without connecting wires, across an intervening space of two to four miles. In the operation of these induction telegraph systems from 50 to 300 electromagnetic pulsations or waves per second are utilized.

Notable as the results obtained by induction telegraph systems were considered at one time, they have been completely overshadowed by those systems in which electric waves or oscillations of a much higher order, namely, from many thousands to several millions per second, are utilized, and to which systems the term "wireless telegraphy" is now generally applied. The term "radio telegraphy" is, however, also much used.

The growth of present-day electric wireless telegraphy has been comparatively slow and the discovery and development of the art can scarcely be placed to the credit of any one mind. In 1864 Clerk-Maxwell demonstrated mathematically the electromagnetic theory of light, which in effect is that electromagnetic manifestations are due to undulations of the all-pervading ether, of a nature more or less similar to the undulations of the ether which produce the manifestations of light, and that, in so far as they differ, it is mainly a difference as to the number of oscillations per second, the undulations that produce the sensation of light occurring, for instance, at the rate of from four hundred million of millions per second, to seven hundred million of millions per second; while, as just intimated, the electric undula-

...of the electromagnetic theory of light, which involved the exist-

...cient in electric waves in free space, many scientists endeavored to demonstrate experi-

...mentally the truth of the theory. This honor fell to Prof. H. Hertz in 1887. It had been showed by Professor Henry in 1842 and by Sir William Thomson (Lord Kelvin) in 1853 that when a Leyden jar or other highly insu-

...lated condenser is discharged, the previous charge is not dissipated in one rush, but gradually, in a series of oscillations.

It is well known that in an electric circuit containing coils of wire the current is perceptibly retarded in rising and falling, which fact is due to a property termed inductance, which all conductors possess. On the contrary, when a wire possesses electro-static capacity the current is assisted in rising and accelerated in falling. The property of inductance is usu-

...like to inertia, while capacity is likened to elasticity, in mechanics. The shortest elec-

...wave thus far produced is about .15 inch in length. This is still much longer than the longest light-wave and 60 or 70 times longer than the longest dark wave we measured.

In the electric circuits employed in wireless telegraphy the resistance is small. In fact, if the resistance be too great the discharge will not be oscillatory. The time of an oscillation period is expressed by the formula...
made part of an electric circuit, have normally a high resistance, but under the influence of electric oscillations they lose this resistance and become good conductors of an electric current. It is assumed in explanation of this effect that the electromotive forces that accompany the electric oscillations in the circuit cause the filings, by electrostatic attraction, to cohere, thereby making a better electrical contact with one another, thus reducing the resistance of the circuit; hence the application of the term "coherers" to this type of electric wave detector. It was also found that when the filings had cohered they retained their electrical conductivity until they were jarred, or otherwise mechanically disturbed.

In 1894 Dr. O. Lodge (now Sir O. Lodge), in a lecture before the Royal Society, London, showed that the filings coherer could be used to transmit signals telegraphically by placing them in a glass tube and making them part of an electric circuit in which were a battery and a telegraph receiver. A simple experiment when the induction coil was operated at a distance of some yards from the coherer the latter was actuated. In order that the filings should not remain cohered after the oscillations had ceased, the hammer of a bell operated by electric wire could be thrown on or tap the glass tube as long as the electric oscillations continued. An electric bell has generally been employed in the later use of the filings coherer. In 1895-96 Popoff and others utilized the filings coherer as a means of detecting atmospheric electricity, employing for this purpose a vertical wire extending many feet into the air, the coherer being placed between the lower end of the vertical wire and the earth.

Theories of Electric Wave Propagation.— Obviously substances opaque to light obscure the passage of the luminiferous ether waves. Analogously it was thought in the early days of electric wireless telegraphy, that the curvature of the earth or sea between points several hundred miles apart would prove a barrier to electric waves traveling, like light-waves, in straight lines, insomuch as it would not be practicable to obtain masts, or other means of support for vertical wires, of sufficient height to overlook the earth. The experiments of Hertz showed that with wires only 200 feet high signals could be transmitted to points between which there was a wall of earth or water 15 or 20 miles in height, due to the curvature of the earth. A number of theories have been advanced in explanation of this fact. For example, that the waves are propagated around the earth by diffraction or reflection, but these theories are not generally held to be tenable. A theory that meets with most acceptance at present is that the electric waves are propagated as sliding waves over the surface of the earth or sea.

Brief allusion may be made to the supposed action that takes place in and around the Hertz oscillator in the production of free electric waves. The theory is very limited, perhaps not more than 10 or 12 feet at most. These devices, however, demonstrated the possibility of signaling to a distance by electric waves. Not long after the announcement of Hertz's experiments Dr. Brain discovered that metal filings, when thrown together loosely and

\[ T = 2\sqrt{L/R} \]

where \( T \) is the time in seconds, \( 2\pi \) is the ratio of the circumference to diameter (3.1416), \( K \) is capacity in farads, and \( L \) the inductance in henrys; resistance \( R \) being neglected.
Typical power plant of a Marconi long-distance station, showing aerial wires leading into the building.

The Yankee Salvage Association's tug Forward, which sends ashore the press reports to the vicinity of New Harbor.
elastic hoops, partially flattened out, their ends resting on the rods. One line of force is assumed to be positive, the other negative. These hoops or lines tightening out and their resistance to inductive and vertical wire, for the transmission of signals, and for the reception of signals, a filings coherer, a telegraph relay, batteries and vertical wire. The general arrangement of Marconi's simplest apparatus is outlined in Figs 2 and 3. In Fig 2, I is the induction coil, a is the interrupter, p is the primary wire, s is the secondary wire of induction coil, B is a storage battery of about five cells. K is the Morse key; b b' are the spark balls. The vertical wire A at its lower end is connected to ball b; the other ball b' is connected with a wire leading to the earth. Balls b b' of the oscillator are thus in series with the vertical wire. The terminals w w' of the secondary wire are also connected respectively to b and b'. The receiving apparatus is outlined in Fig. 3. The Marconi filings coherer is shown at k. It consists of a glass tube, suitably upheld, about 1.57 inches long and .1 inch inside diameter. The filings, a mixture of 90 per cent nickel and 10 per cent silver filings, are inserted in a small space between two plugs n, which fit snugly into the tube which is exhausted of air. Small wires extend from these plugs to the outside of the tube. One of these wires is connected with the vertical wire A, the other with a wire leading to the earth. Hence the coherer is in series with the vertical wire. The relay R is in a shunt circuit with a single cell of battery b and the coherer, as shown. The armature lever l of this relay controls the local circuits of the electric bell T and an ink recording register E, which are operated by local battery b' of four or six cells.

The actual transmission of messages is effected by means of key K, Fig. 2. Each time the key is closed the vibrator a starts into operation with the result that electric oscillations are set up in the vertical wire and a train of electric waves is radiated therefrom in the ether. Thus by opening and closing the key for shorter or longer times the train of horizontal waves is broken up into signals corresponding to dots and dashes which are received as such at the receiving station. The operation at the receiving station is practically as follows: Normally the armature lever l of the tapper T is given a tension which holds it against the contact c. Normally, also, the armature lever l of relay R is on its back stop x. Hence at this time the local circuit of battery b' is open. When then the electric waves set up by the oscillator...
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arrive and electric oscillations are thereby excited in the vertical wire at the receiving station, the resistance of the coherer drops sufficiently to allow the battery \( h \) to energize the relay \( K \) and its lever \( l \) moves over to contact \( x' \), closing thereby the battery \( h' \), whereupon the electromagnet of tapper \( T \) attracts its armature \( l' \), which act opens its own circuit at contact point \( c \). At once the armature of \( T \) flies back on its contact point, at the same time striking the tube, decelerating the filings and demagnetizing relay \( K \), whose armature lever returns to its back stop \( x \). Immediately, however, the filings again cohere (assuming that the oscillations continue), with the result that \( K \) is again magnetized, the actions just described being repeated many times in a second. Hence, while the oscillations are being received the tapper keeps up a buzz or hum, which stops when the oscillations cease. Likewise, while the oscillations continue in the receiving vertical wire the inking register \( E \) is actuated and dots and dashes are impressed on the paper strip. The paper strip is started and stopped automatically, by devices well known in telegraphy, when signals commence and when they cease. Consult Mayer, "American Telegraphy and Encyclopedia of the Telegraph" (p. 373).

Detectors.—It was early evident to those most concerned in the practical operation of wireless telegraphy that a detector which would "open" on the occurrence of electric oscillations and "close" without tapping when the oscillations ceased was desirable. Such devices were not long in forthcoming. They are termed detectors.

One of the first detectors used in wireless telegraphy is due to Castelli. Detectors have also been devised by Marconi, DeForest, Fessenden and others. The Castelli detector is outlined in Fig. 4. It consists of a glass tube

![Fig. 4. — Castelli Detector.](image)

K, 1.7 inches in length, a carbon rod \( c \), a plug of iron \( t \) within the tube, and a small drop of mercury \( m \) placed between \( c \) and \( t \). The rod \( c \) and plug \( t \) are adjustable within the tube by the screws \( k, h, A \). \( A \) is the vertical wire which is made a part of the coherer circuit. A telephone receiver \( t \) and a small battery \( h \) are placed in a shunt circuit around the detector. Normally, the imperfect contact between the mercury and the carbon causes a high resistance in the detector, but when electric oscillations occur in the circuit the mercury and the carbon cohere and the resistance falls very rapidly. The consequent variations of current in the shunt circuit produce sounds in the telephone receiver of long and short duration corresponding to the dashes and dots transmitted. This detector was used extensively in the Italian navy and was used by Marconi in some of his trans-Atlantic experiments.

Among other detectors are the carbide, due to General Dunwood of Washington, D.C.; the DeForest Audion, and the Silicon detector of Mr. G. W. Pickard of Amersbury, Mass. The Dunwood detector consists of a small crystal of carborundum clamped at its edges between two metal electrodes or terminals. It is placed in circuit with a small battery and a telephone receiver. Its operation appears to depend on the heat, due to the local battery, at the minute points of contact, which heat reduces the resistance of the carborundum. Incoming oscillations affect this resistance and thus produce sounds in the telephone. The sensitivity of this detector is somewhat greater than the filings coherer. It possesses the advantage for shipboard use that jarring does not disturb its operation.

The Silicon Detector.—Detectors of this type are now termed crystal detectors. The detector employs in its operation the principal of the thermo-electric couple. (See Thermoelectricity). The electrodes or thermo-electric couple employed by Mr. Pickard in his receiver are pure silicon and a metallic element of low resistance under a certain mechanical pressure. This couple is placed in the receiving oscillating circuit in which is also placed a telephone receiver, but no battery. According to the invention the received oscillations are converted into heat at the thermo-electric couple, the amount of heat developed being in accordance with the CR law, the energy of which is converted into direct electric current which are heard in the telephone receiver as sounds. Tests by Pickard of a number of the best known electric wave detectors show that the amount of energy required to give a just discernible dot (or sound) in the telephone receiver is as follows: Electrolytic detector to .000060 Erg.; Magnetic detector .000100 Erg.; Silicon detector .000150 Erg.; Carborundum detector .000400 Erg.

Vacuum Tube Detectors.—The useful detector of wireless telegraphy and telex signals today in the vacuum tube detector, which has been known for a number of years, is the vacuum tube detector, in which the air or gas surrounding an incandescent wire or filament is ionized due to electrons escaping from the incandescent body. The hot filament was discovered in the last century, but to this fact, the correct explanation was not forthcoming at that time. Thus in Houston's "Electrical Directory," published in 1892, the Edison effect is defined as follows: "An electric discharge which occurs between one of the terminals of the incandescent filament of an electric lamp placed near the filament but disconnected therefrom, as soon as a certain difference of potential is reached between the lamp terminals. The effect of the discharge is to produce a current in a circuit connected to one pole of the lamp terminals and another metallic plate, as may be shown by means of a galvanometer." The vacuum tube detector is based primarily on the Edison effect. Apparatus and circuits to show this effect are outlined in Fig. 5. An electric current from a battery \( A \) heats the filament or wire \( F \) to a desired temperature, when it is found that a platinum plate \( P \) adjacent to \( F \) becomes positively electrified to a few volts, as shown by a galvanometer \( G \), indicating that the intermediate gas is ionized or rendered electrically conducting. In the later use of vacuum tubes for X-ray work, wireless
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Gratory and telephony, very high vacuums used which give a pure electron discharge, greatly improved results, especially perhaps X-ray work.

The number of electrons flowing from the plate to the plate in a high vacuum tube depends on the temperature of the filament and potential or space charge of the plate. The amount of current in the filament to plate circuit depends on the number of electrons received or emitted from the filament and has an calculated to correspond to 10^8 electrons per amper. After a certain increase in the operation of the filament, which is limited by strength of its material, and at a certain active potential of the plate, saturation is reached. The flow of electrons, which are asked to be negatively electrically charged particles, is apparently from the filament to the plate, which is charged with positive potential, so the current flow is from the plate to the filament.

As already noted the bulbs used in this serve require an exceedingly high vacuum for proper operation. It is also important that the filament and other metallic elements of tube be free of gas.

Fleming Valve Detector.—Fleming improved upon and utilized the foregoing Edison device by making it a wireless detector known as the Fleming valve or current rectifier. Fig. 6 shows the circuit of the detector. Plate W is part of an oscillation circuit S, C, F, W. Filament F is brought to incandescence by the battery B; this releasing electrons at the filament. Incoming oscillations from the aerial due to arriving Morse signals set up alternating currents of positive and negative potential on plate W. When the plate is charged positively the negative electrons are drawn over from the filament, increasing the potential on W, which in turn charges the condenser C at that instant. When the plate W is charged by incoming negative oscillations electrons do not pass from F. Hence positive or unidirectional currents only are allowed to pass. Between the positive charges of plate W, the condenser C discharges through the telephone receiver T, thereby reproducing the transmitted dot and dash signals.

The De Forest Audion.—To the Fleming valve de Forest added a metal grid G (Fig. 7) between the filament F and the plate P, making it a three electrode tube VT. He also added a potential battery PB to plate P, which combination produces remarkable results. De Forest termed this device the audion, from the words audible and ion. A is an aerial; p, s, are the primary and secondary coils of the tuning or receiving transformer L. TC is a variable, or adjustable, tuning condenser. C is the grid condenser. The grid G intercepts the electrons flowing from F to P, and it is found that a given variation of voltage in the grid produces a greater variation in the plate currents than is effected by a similar variation of potential on the plate P with the grid removed. The incoming oscillations from the aerial in the grid-filament circuit are repeated or relayed into the grid-plate circuit more or less amplified. This fact constitutes the audion an amplifier of current and consequently of sounds, and because of this relaying property the audion is also termed an electron relay.

Figs. 6 and 7 may be regarded as showing theoretically the ordinary wireless receiving circuits in which the respective detectors indicated are employed.

Another way of regarding the operation of the vacuum tube is to assume that the heated filament sets up a negative electromotive force due to the presence of negative electrons. The potential battery PB produces a positive potential at the plate. The conventional explanation then would be that the current flows from the positive potential at the plate to the negative potential at the filament; the battery in this case providing the supply of electrons or in other words, the current. On this hypothesis a reduction of the negative potential at the filament, the potential at the plate remaining the same, will cause a reduction of current between F and P. Similarly a reduction in the positive potential at the plate will reduce the current. By obtaining control of the potential of the plate...
and grid a variation in the output of the tube is obtained. The grid element in the tube provides a means of varying the plate potential, and reversely a variation in the plate potential affects in an opposite sense the potential of the grid.

The three electrode vacuum tube has recently undergone great improvements at the hands of many experimenters, and it is now not only utilized as a detector and amplifier of wireless telegraph and telephone currents, but also as a generator of high frequency electrical oscillations and a modulator of radio waves in Wireless Telegraphy (q.v.). This tube is also employed as a repeater or relay in long distance wire telephony and indeed it is largely due to the amplifying and relaying properties of this instrument that trans-continental telephony is commercially possible.

There are at least three variations of this tube now in use, termed, respectively: The kenotron, the plotron and the dynatron. The kenotron rectifier utilizes the unidirectional property of the current between a hot and cold electrode in vacuum. The plotron utilizes the space charge property of this current which allows the current to be controlled by the electrostatic effect of a grid. The dynatron utilizes the secondary emission of electrons by a plate upon which the primary electrons fall; it is, as its name indicates, a generator of electric power and feeds energy into any circuit to which it is connected. For fuller information on this subject the reader is referred to the Journal of the Institute of Radio Engineers, September 1915, and to the bibliography appended thereto. For details relating to and for other examples of circuits in which the three electrode tube is utilized see Telegraphy, Wireless.

The Vertical Wire or Aerial—Marconi's first experiments in wireless telegraphy were made with a vertical wire 20 feet high at the sending and receiving stations. With this height of wire he transmitted signals one mile. With wires 40 feet high signals were transmitted four miles and with wires 80 feet high 16 miles. Many different arrangements of the aerial wires are now employed. For instance, in a number of wireless installations 20 wires about No. 16 gauge are suspended from a long strip of wood, which is upheld by insulators supported by a rope between the tops of two masts about 150 or 200 feet high. The wires, two feet apart, drop vertically to a similar wooden strip, where the wires are joined together and led into the instrument room. In other cases the wires are suspended from towers by well-insulated arms and are kept apart by wooden spreaders until near the ground, where the wires are connected and then are carried into the operating room. In still other cases a single mast is employed, from the top of which a number of wires are suspended. Each wire is attached, at a distance of about 50 feet from the top of the mast, to a guy-ropes, which is itself attached to an anchor post in the earth, 40 feet or more from the base of the mast. The guy-ropes thus drawn the wires away obliquely from the mast, then at its point of connection with the guy-ropes each wire is directed to the mast. Between all wires the insulator. The effect of the mast as a base and no spreaders is required.

In Fig. 8 are shown various ways in two or more aerial wires may be used. The wires may be of different lengths depending on requirements. In the arrangement shown at c indicates a four-wire arrangement is a cage arrangement of four, six or eight wires in which the wires are held at a hoops; g is a box method in which wires are separated by a wooden block. The plan shown at c is much used. The in this case are held apart by wooden spr}

![Diagram](attachment:image.png)
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If closely adjacent parallel wires is not, proportionally to the number of such ut is equal, roughly, to the square root number of wires. The capacity of a wire 1 inch in diameter and 100 feet h is .0002 micro-farad (Fleming). Ordinary service the grounded antenna found to operate satisfactorily, but circuits the direct earth connection some disadvantages. Thus variations existence of the earth connections added difficulties in the way of maintain tuning or syntony. (Described sub.). Shipboard practice the aerials A are try extended in a sort of cage arm C from the heads of the fore- and stern as outlined in Fig. 9. The cage con-

![Fig. 9. — Shipboard Aerial Wires.](image)

arrangement the horizontal wires, which possibly give a directive tendency to the aerial waves, are connected at the far end. The horizontal wires are supported by porcelain insulators K, about two feet in length, and are attached to the masthead M by suitable tackle T, which uphold the spar P 15 feet in length and to which the insulators are fastened. The horizontal wires are two and five feet apart.

Condensers.—The condensers used in transmitting circuits for installations up to one or two kilowatts are generally of the Leyden jar-type. Such jars, 16 inches high by 5.25 inches in diameter, have a capacity of .004 micro-farad. For more powerful installations, large plate-glass condensers immersed in oil, contained in insulated tanks, have been used by Marconi, De Forest, Fessenden and others.

Generators of Electric Oscillations.—The need of greater radiating power in long distance wireless transmission than is obtainable from the ordinary induction coil, as well as the unreliability of the interrupters of such coils, when used with large currents, which soon wear out the contact points, has led to the adoption of special types of transformers. Instead of battery power also, alternating current generators are employed as the source of electromotive force for these transformers. The power of the generators may vary from 1 kilowatt to 300 or more kilowatts. The rate of alternations of the transformer depends on the frequency of the generator. The electromotive force in the primary circuit of the transformer may be from 50 to 200 volts, which is greatly increased at the secondary terminals of the transformer; in some cases to 20,000 or 50,000 volts. In the case of the New Bruns-
wick, N. J., transatlantic station a 60-cycle 24,000-volt current in the secondary circuit of the transformers is employed to charge the large glass condensers, which in discharging produce the high frequency oscillations thrown upon the aerial wire.

In addition to the spark gap method of generating high frequency oscillation in wireless telegraphy, as described in the foregoing, by means of induction coils, several other methods are now employed, among them the carbon arc generator, the high frequency machine alternator and the three-electrode vacuum tube oscillator, to which reference will be found in article on (Wireless Telephony (q.v.)). Consult Anderson and Elliott, 'Poulton Book' (Electric Work, 30 Aug. 1919); 'Trans-Atlantic Radio Communication' ('Proceedings,' American Institute of Electrical Engineers, 1 Oct. 1919). Marconi has also developed a successful method of obtaining sustained oscillations by means of rapidly rotating metal disks which by suitable arrangements of capacities and inductances set up rapid charges in an oscillation circuit. For a description of this oscillator consult 'Transactions,' Royal Institution (London, March 1908) or Mayer, 'Wireless Telegraphy and Telegraphy' (Part 2, page 9).

Syntony or Tuning.—An important defect of wireless telegraphy in the simple form thus far described consists in the fact that but one message can be sent at one time, for it is that if it is attempted to send two messages at once in the same vicinity, the signals will clash. Many inventors have striven to overcome this

![Fig. 10.—Shipboard L Aerial.](image)
defect, among others Lodge, Marconi and Slaby. The plan followed by these workers has been that of employing a synergetic or tuning method; that is, a method by which the transmitting and receiving circuits are adjusted or attuned to a fundamental rate of electric oscillations, to which rate of oscillations and no others the receiver so attuned will respond. This is done by taking advantage of the fact that the rate of oscillations, or the frequency of an electric circuit is proportional, as already noted, to the inductance, capacity and resistance of the circuit. Hence by varying the capacity or inductance of the tuning circuits any desired rate of oscillation is obtained. Tuned circuits are termed selective circuits, since by sending out a given rate of waves any desired tuned circuit within mixing signal may be selected as the receiving station.

Tuning also possesses the advantage that the benefits of resonance may be obtained by its use as follows: It is known that a vertical wire grounded directly at its lower end is an excellent radiator of electric waves, but as it possesses very little capacity its oscillations are quickly damped as indicated in Fig. 11 and it is only the first few oscillations that are of sufficient strength to affect a receiver. When capacity and inductance are added to a circuit in certain proportions it may be made a persistent vibrator (Fig. 12) and consequently a given amount of electrical energy expended at the transmitting end producing a succession of waves of more uniform amplitude will have a cumulative or resonant effect upon a receiving circuit of equal capacity and inductance, and will eventually cause it to respond to the waves emitted by the transmitter, while an untuned receiving circuit containing a detector as sensitive as the first one, would probably not respond to those particular oscillations. In the case of tuned circuits, this is doubtless because the faintest oscillations, or electromagnetic forces, excited in the receiving circuit are resonantly amplified by the incoming waves of a selected frequency until they affect the detector.

As a rule, the spark-gap and the receiving apparatus of untuned circuits are connected directly to earth as indicated in Fig. 13, in which \(A\) is the antenna; \(b\) is the spark balls or knobs; \(a\) is the spark-gap; \(S\) is the secondary and \(P\) is the primary of an induction coil or transformer. In such an oscillating circuit \((A, b, b)\), the oscillations are quickly damped. In the case of tuned circuits, or where, at least, the effects of resonance are desired, there is provided a closed oscillating circuit which is separated from the capacity and inductance of the transformer. Such an arrangement is outlined in Fig. 14. The closed circuit in this case consists of the spark-gap, condensers \(c\), and the primary of transformer \(T\). In practice the condensers and the inductance coils are made adjustable, so that the capacity and the inductive may be varied at will. Best results are obtained when the oscillating circuit and the vertical wire have equal fundamental oscillation periods, or when the one is a multiple of the other. Oscillating circuits arranged as in Fig. 13 are said to be tightly coupled. When arranged as in Fig. 14 they are said to be loosely coupled.

In addition to the fact that the oscillations on an ordinary vertical wire are quickly damped there is the further fact to be considered that the oscillations set up by a spark-gap transmitter are not continuous in the strict sense of the word, since there is a perceptible time while the oscillation circuit is being charged, the breaking down point of the air-gap, during which the oscillations tend to die out. Several inventors have striven to obtain a transmitter capable of supplying undamped or practically uniform oscillations to the oscillation circuit. Poulsen has developed some improvement in this direction by a modification of the Duclieu singing arc (described in his British patent No. 21,620). (See TELEGRAPHY, WIRELESS). Briefly it consists of an arrangement in which an arc lamp supplied by a direct current is placed in parallel with a capacity and an inductance. When the capacity and inductance are suitably chosen, rapidly alternating currents are set in this arc which produce a tone—hence name singing arc. In Poulsen's modification, this arrangement the negative electrode of the arc is carbon, while the positive electrode is copper, the arc being enclosed in a box containing hydrogen gas. The arc is shunted by a capacity and inductance and rapidly alternating currents are continuously set up which are thrown on to the vertical wire in the usual way. With the Duclieu arrangement the frequency of oscillation was about 10,000 to 15,000 periods per second—too low for utilization in wireless telegraphy. A much higher frequency is obtained by the Poulsen arrangement which is attributable to the arrangement. Further the cooling of the electrodes (an essential first noted by Elihu Thomson, in United States Patent No. 500,630), the copper electrode is made in the shape of a hollow ring through which water is passed. Tests have demonstrated that by this method of setting up undamped oscillations it is possible to signal over greater distances with much less electrical energy than is required with the spark-gap method.

Quenched Spark Transmitter.—Weiss in 1906 discovered that very powerful discharges possessing advantageous properties for wireless telegraphy could be obtained from very short spark-gaps. To avail of this discovery Van der Waerden employed as an oscillation generator, a device consisting of a metal box containing two copper plates separated by a very thin sheet of paper provided with a small aperture in its centre. The terminals of the usual charging electromotive force are each connected
The velocity $V$ of propagation of the waves being equal to that of aves, 186,000 miles per second, the wave then equals velocity divided by frequency wave length equals,

$$V \sqrt{K L} = 2\pi V \sqrt{K L}.$$  

Ordinary practice resonance is indicated loudness of received signals in the tele-receiver.

of the early wave meters, the Donitz in Fig. 15. A brief description of the will explain the general principle on wave meters operate. The Donitz wave consists of a coil of wire $C$, about eight in diameter that may be placed in the oscillation circuit to be measured, anode, coil $C$ which may be a loop in an circuit. Coil $C$ is in series with a con- and another coil of wire $c$, $c$ is in relation to a smaller secondary wire the circuit of which is a small heat wire fixed in one end of a U-shaped tube $T$, filled with a colored liquid. The capacity is made of two sets of semi-circular metal one set fixed, the other set movable to or fixed plates, the whole being contained as case and immersed in oil. The moves are operated by means of a knob $N$ to which is also attached a pointer $P$, which moves around a graduated scale $S$. The capacity $K$ of this oscillation circuit varies with the

![Fig. 15 — Donitz Wave Meter.](image)

![Fig. 16 — Marconi Tuned System.](image)

![Fig. 17 — Marconi Tuned System.](image)
up transformer and is used to increase the efficiency of the apparatus by enhancing the electromagnetic forces acting upon the coherer; availing of the fact that there is a node of electromagnetic force and a loop of current at the foot of the vertical wire—that is, at that point the electrostatic energy is at minimum while electromagnetic energy is at maximum. K is the Marconi filings coherer, which is in series with the secondary coil s s of the jigger. A small condenser c is connected as shown, forming a short circuit for the oscillatory currents across condenser c, thereby precluding any diversion of these currents through the relay R. This is a polarized relay of from 1,200 to 10,000 ohms resistance, in the circuit of which is a single cell b. The relay is usually inclosed in a cylindrical case to exclude dust. Some of the relays used for this work will respond to a current of 0.1 ampere of an ammeter. In practice this relay, the jigger, the coherer and tapper are enclosed in a metal sheathed box to prevent the action of external electric waves upon the coherer. For the same reason the local contacts of the relay and tapper are shunted with resistances, not shown in the figure. The Morse key employed is massive, with front and back contacts which are insulated from one another. It is provided with a large vertical handle to protect the operator against shocks. The use of the coherer for commercial use has been displaced by more modern devices.

The Fleming Long Distance Transmitting Circuit.—In Fig. 18 is shown diagrammatically an arrangement, designed by Prof. J. A. Fleming for the Marconi Wireless Telegraph Company, to be used in long distance transmission. In the figure, D is a 500 or 1,000 volt alternating current generator of 10 or 20 kilowatts capacity, and having a frequency of about 50 per second. T, T' and T'' are transformers. The primary circuit of T is in series with the generator D, and the coils i, i'. The transformer T raises the electromotive force to about 20,000 volts, charging the condensers C, which discharge across spark-gap S, setting up oscillations of a high order in the oscillating circuit O, S, C, T'. These oscillations are again transformed to higher voltage in the secondary of T", which in turn excites the vertical wire A, the discharging in the oscillating circuit O', S', C', T", still further increases the electromotive force thrown upon the wire or wires A. The estimated electromotive force obtained at the vertical wire in this way is about 100,000 volts. These condensers are of glass immersed in oil and the transformers are of special construction to withstand these high pressures and to have desired capacity and inductance. To directly opening and closing the primary circuit of the transformer T, the two contacts I, having movable iron cores, m, m', are in that circuit. The iron core m' of i is adjusted so that as much current as may safely pass through the primary of T shall have no flow in the circuit. The core m of i is made of its full length in the coil, and its iron is sufficient to stop all flow of alternating current in the circuit. This coil may, however, be short-circuited by the key K, in dot and signaling, at which times the current attains full value. Hence the circuit is not opened at the usual sense, but to avoid sparking the exact points of key K may be immersed in oil.

In Fig. 18a is shown theoretically a transmitting apparatus and circuits employed in ordinary ship and land stations.

![Fig. 18a.—Modern Transmitting Circuit. Lead on board Station.](image-url)

**Fig. 18a**—Modern Transmitting Circuit. Lead on board Station.

is a motor-generator controlled by a starter not shown. The motor is usually supplied with current at 110 volts pressure. The generator G may develop from 110 to 500 volts as desired. QS is the spark-gap (quark type). K is a Morse key in the primary circuit of the transformer T. Specially designed keys for this work will open the circuit with excessive sparking with a current of 25 and 110 volts. The voltage in the circuit C', OT, QS, may be raised to 10,000 or more by the transformer T. C represents Leyden jars or condensers and the oscillation circuit is connected by loose contact to the aerial A, by means of oscillators O and T. The oscillation transformers OT may consist of two independent heavy bar copper wire with widely separated spirals and with one of the coils movable side to side of the other for varying the coupling. Clips m are also provided whereby more or less of the coils may be connected in the tuning. L is a tuning inductance in the circuit C. is a condenser used for short wave work. It may be cut out as in the figure by CS. A is a hot wire ammeter placed in the aerial to show when oscillations are thrown upon the aerial and to indicate the strength of current therein. Resonant circuit between the circuits when h is at maximum. S is a safety device to discharge excess current in the circuit to ground. A motor starting arrangement for the motor-generator is also described in the author's work *Telegraphy and Telephony* (page 103).
TELEGRAPHY, WIRELESS

Motion, Directive Signaling and Finders.—In ordinary wireless telegraphy, the electric waves are radiated from an antenna in every direction, as, for instance, from light waves from a lamp on a pole or a lighted candle in every direction. Attempts have been made to reflect and direct electric waves, but by means of metallic or other means. These attempts were not successful in meeting the requirements of the reflecting mirror in compensation with the length of the wave to be radiated, and that the mirror should not be further than a quarter of a wavelength from the oscillator or source of the wave. This difficulty results from the fact that the electric waves used in telegraphy and telephony are of the order of 100,000 per second. On the contrary, the length of a wave is so infinitesimal that the smallest possible to construct, or even particles of light large by comparison with light waves, have been met with in the direct signaling by methods differing from the mirror reflection method. Before some of these methods it may be pointed out that the theory of wave undulations or oscillations of simple form are frequently shown graphic-sinusoidal curve, or sine wave, describing the motion from the point to a wave of a point on the surface of a rolling wave, or from the nade by the movement of a pencil through the movement of the pencil corresponding point moving back and forth along the edge of a circle. In Fig. 19, the vertical may represent such a back and forth

The line AB represents the forward motion of the wave, and x x' the distance covered by each cycle of the wave, this corresponding to the distance x x'. In wave motion, it is understood that the particles of the medium do not move forward with the wave, but merely rise and fall like chips on the surface of a pond as the waves pass under them. As the wave progresses, each particle of the medium in turn rises to the crest and drops to the bottom of the wave. In a liquid, the medium it is assumed that the particle is displaced from its zero position by a force or strain which it resists with a counter force termed stress, the stress varying with the extent of the displacement, and tending to restore the particle to zero position. The position of a point or particle at a given instant relative to any fixed position is termed the phase, and the difference of position of a given particle relative to another particle during its motion over a circle is termed phase difference. Thus a particle at b will pass through point C in advance of particle a, the direction of motion being as shown by the arrow, and their phase difference when measured as an angle will be equal to the difference of the angles made by their radii with a fixed line A x. For example, the difference of phase between a particle at C and one at x is 90°, or one-fourth of a wave length; while a particle at C and one at A will have a phase difference of 180° or one-half wave length. When two particles pass through the same point at the same time they have no phase difference. Any two particles one wave length apart are said to be in the same phase, and two waves of the same frequency whose corresponding parts are moving in opposite directions with the same velocity are said to have a phase difference of 180°. For present purposes the broken curved line in Fig. 19 may be considered to represent the contour of an electric wave, while that portion of the curve above the line x x' may represent an electric positive force or sign; that below the line a negative force or sign, and the magnitude of the force of the wave at a given point and instant may be represented by the length of the vertical lines between x x' and their point of intersection with the curve. In this view, waves of different or equal phase and magnitude and agreeing or opposing in direction or sign may be caused to assist or neutralize one another, more or less; some instance of which is given herein, and analogous instances of which may be found in textbooks on light and sound.

Electric Wave Localizer.—A device due to John Stone Stone for determining the direction from which wireless telegraph signals are emanating is shown in Fig. 20, theoretically. In the figure, A represents vertical wires placed on a common axis a, and in series with which are coils of wire x y respectively. These coils are so wound that when oscillations of equal strength and direction simultaneously pass through them from wires V V' the coil z, which is in inductive relation to those coils, will not be affected. When the oscillations in coils x y are in opposite directions or differ in strength coil z will be affected. Coil z is in series with detector d, condenser C and telephone receiver t. In order to obtain the maximum effects of the wave energy the wires V V' in this arrangement are placed the distance of half a wave length apart, which distance can be ascertained by means of a wave meter. Assuming the length of the arriving waves to be
50 feet, the wires 25 feet apart, and that their plane is in the line of motion of the advancing wave, the wires will receive the waves at a phase difference of 180° or half a wave length. Hence the oscillations in the wires due thereto will be of equal strength, say, 10, as indicated in the figure, but opposite in sign, or direction, in coils $x$ $y$, and the coil $z$ will be inductively affected to a maximum extent. If the wires upon $z$ are zero which will be with of the wires is at right angles to of the arriving waves. According to the apparatus of this device has never been used with a wave length exactly twice the distance between the two aerials or verticals $V$ $V'$. The object in having the wave equal to twice the said distance is that arrangement gives maximum intensity signals, the signals under all conditions to be maximum when the plane of the wave right angles to a plane down through antennas; the signals being canceled coils $x$ $y$ when the plane of the waves is with the plane passing through the vertical wires. Consult U. S. Patent No. 716,133, covering this device.

**Bent Antennas in Directional Signaling**—De Forest states that vertical wire to which is attached a horizontal wire signals are received by of the detector in the vertical wire, the sum of which signals appear to vary according to the position of the wires approach or from a position of parallelism with the direction of travel of the waves. The various arrangements of $T$ and $L$ antenna so largely employed for capacity on board ship and in stations correspond more or less to a going device but practical experience definitely indicate that in ordinary working the signals are affected favorably otherwise as regards the directive effect on signaling by such arrangement of the aerial wires.

Marconi has made numerous experiments relative to directive wireless signaling and found that by placing a large number of $w$ arranged as an $L$ aerial, or bent antenna with the open end pointing away from the distant station the direction of effective $v$ may be largely controlled; also that by similar antennae the reception of signals is improved. Braun, Artom and others have experimented with directive aerial devices, an account of which may be found in textbooks on wireless telegraphy.

**Bellini-Tosi Directive System and Devices**—Bellini and Tosi in their experiments in France

strength and direction will then be set up in the vertical wires, the effect of which on the coil $z$ is nil, owing to the differential winding of the coils $x$ $y$. To determine then, the direction of arriving waves it is only necessary to turn the wires $V$, $V'$ on their axis $a$ until the combined forces of the oscillations in coils $x$ $y$ a triangular nearly closed aerial in of rotation on its axis, using a receiver somewhat similar to those described. Like other experimenters Tosi found that the strength of signals was a maximum when the triangular transmitting circuit $v$
m of the receiving station, and that upon the triangle on its axis directing its way from that station the strength of gradually weakened and was always zero at the extreme distance of the retransmitted wave. To avoid the difficulties involved in use of movable aerials for directive purposes, inventors devised the plan of using sets of triangular aerials, placed at right angles to one another, as outlined in Figs. 24, in which W E indicate the two upper parts of the triangle and N S' similar sides of the latter. In connection with this arrangement of aerials a device termed a radio- meter n w C is utilized in which will be certain resemblance to the Stone localizer as previously described. The radio-photometer consists of two fixed coils n w at right angles to each other, and of a central coil C movable pivot in any direction within the coils W E. When the atmosphere was not coil C, 1, 23, is the primary of an oscillation meter with two secondaries, n w. When reception of signals, as in Fig. 22, coil n serves the secondary of two primaries n w. At time inductive effects will be inappreciable in coil w, but will be a maximum in coil n, a direction of transmission will be N S. Primary coil is placed parallel with coil direction of radiation will be W E. If sired to send signals in any direction between W N or E S, effect is by placing n the desired position in case each w will be acted upon proportionately to coil C, and the direction of radiating will be a resultant due to the combination of two electromagnetic forces developed by coils n w, virtually according to the law parallelogram of forces. In Fig. 21, for e, with coil as shown, the resultant directed be as indicated by the dotted lines e length N s, respectively represent the assumed magnitude of component forces in the direction indicated by lines; or if the coil C be turned in the m of dotted or resultant line, the mag of the component force due to coil w be reduced by the amount indicated by intersecting dotted line at e, while the common force due to coil n would be indicated dotted line n. Reversely when the radiometer is used as a receiver or direction Fig. 22, the incoming wave fronts will the closed aerial oscillation circuits, as stated in connection with Fig. 20. If an entering wave front is in the plane of coil n only will be affected and coil C ed by the operator until maximum current signals are obtained. If, on the other hand, wave front is advancing from a directway between N and E, the coils n w equally affected, and the position 1 C will be as indicated by the dotted line 8. The foregoing described device added importance from the fact forms the basis of the now well-known u-Bellini-Tosi Direction Finder. (Con-
TELEGRAPHY, WIRELESS

$A$ is the aerial. $B$, $B'$ are branched circuits from the aerial, coupled differentially, to a detector circuit $C$, $C$, $C$. $T$ is a head telephone receiver. The assumed operation of this device was that if one of the branch circuits, say $B$, be attuned to arriving signals and the other branch, $B'$ be not so attuned, the attuned circuit would respond to arriving signals while the untuned branch would not respond, and, further, that the static currents, being forced vibratory, would pass through both branches in equal strength and would, therefore, cancel each other in the differented coils. It has been pointed out, however, that the static currents are also responsible to tuning of the branches to different rates of oscillation which prevents the desired cancellation of the static currents in $B$, $B'$, hence the static noises will be heard in the receiver. Consequently, any apparent benefit derived from this arrangement must be due to the loose coupling of the circuits, which diminishes the strength of the static currents.

Dickman designed a protective shield of wires to be placed over and around the wires of an $L$ antenna to cut off the static currents from the aerial and divert them to the earth. This device is expensive since it practically duplicates the regular antenna, but it largely diverts atmospheric currents from the aerial proper. It does not, however, divert horizontal electromagnetic stray lines from the antenna.

**Weagent Anti-Static Device.**—The principle involved in this device is the outcome of Weagent's remarkable discovery that the statics producing the greatest interference in wireless telegraphy are not parallel with the waves due to radiation from wireless telegraph stations, but are vertical in direction. It is beyond the scope of this article to give more than a brief description of the methods which Mr. Weagent has invented to avail of this discovery. For a full description thereof the reader is referred to the Journal of the Institute of Radio Engineers, March 1919.

Granting the accuracy of Mr. Weagent's assumption as to the vertical direction of static currents or waves the direction of their propagation will be at right angles to that of advancing wireless telegraph waves. The problem then was to separate the wireless signal waves from those due to statics in the antenna circuit.

The Weagent arrangement of circuits and apparatus to effect this result is shown theoretically in Fig. 25, the explanation of which will perhaps be simplified by reference to the description of the Stone Direction Finder and the Bellini-Tosi goniometer, herein. For his purpose Mr. Weagent arranged two loops $l$, $l'$ of aerial wires supported on poles, the receiving station being at $X$. The length of each pole is, say, three miles, although the inventor experimented with loops of varying less than three miles. The supports are 30 feet high. The wires of the loops are spaced 15 feet apart on the poles. Each loop is connected at $X$ in series with a condenser $C$ and one primary coil $p$, $p'$ of a radio goniometer, the secondary coil $s$ of which is coupled with the tuning coil $t$ of a wire receiving circuit containing the usual variable condenser $m$, detector $d$, battery $b$ and phone receiver $T$. Variable inductances $i$ and resistances $r$ are placed in the loops $l$, $l'$ for adjustment purposes. The coil $s$ may be rotated into a desired position.

The vertically moving static waves are indicated by the downward arrows $a$, $a$, the two static waves due to wireless signals indicated by the horizontal arrows $a$, $a$. Since the static waves cut both of the loops simultaneously the currents set up by them in the primary coils $p$, $p'$ of the goniometer (bound oppositely to each other) are in phase and produce no effect on the secondary coil $s$ of that apparatus. But the arriving signal waves cut the respective loops at different times with the result that the currents set up thereby are not in phase and a preponderant current is produced in one or other of the primary coils of the goniometer, which current in the secondary $s$ of those coils is heard in the detector circuit as in a wireless telegraph operation.

Mr. Weagent in his paper states that to obtain tuning in the loops an inductance coil $i$, $i$ of 30 millihenrys is placed in the upper wire of each loop and best results are obtained when this inductance is placed near the middle, when the tuning is at a maximum. A similar coil placed in the lower wire of a loop effects no change in tuning. Experiments showed that the coil of 30 millihenrys was best for a wave-length of 12,000 meters while a coil of five millihenrys gave best results for a 6,000-meter wave. Both values, however, were satisfactory for either length of wave with loops three miles in length. While the foregoing device was efficacious in getting rid of the vertical statics termed grinders, it was found, in long-continued tests.
by Mr. Weagent with a two-wire system installed at Lakewood, N. J. Interference due to clicks or horizontal could not be altogether eliminated by a wire loop arrangement. Mr. Weagent, however, termed grinders as such produces in the telephone receiver ainoous rattle with occasional crashes, and are noticeable in warm than in cold weather. On the other hand, clicks, which are spaced crashes in the telephone, are noticeable in cold weather, but they are continuous in their action as grinders. It is found that with the two-wire arrangement clicks interfered more with the reception of signals emanating from comparatively low power stations as far afield as Ireland, and the Eiffel tower, and that it is devised to reduce the effect of the so-called weakened signals. On the other hand, clicks were not of sufficient strength to impair signals received from the powerful stations at Carnarvon, Wales, or Germany.

Means of another device due to Mr. Weagent and shown in Fig. 26, it became possible to eliminate the statics due to clicks to the extent that the signals from the weaker stations were easily readable. Since it was demonstrated by the experiments referred to, the two-loop aerial picked up vertical waves and horizontal electromagnetic waves. Mr. Weagent conceived the idea of using the two-loop aerial as a tank or resonator for the static waves that produce the clicks and clicks, and then avail of these at a given instant to balance out by means of the practically similar waves picked up in a third aerial that would convey the receiving circuit proper in the manner to be described.

Fig. 26.—Weagent Three-Wire Aerial Static Eliminator System.

Messages may be successfully received from across the Atlantic Ocean, with apparatus, including the entire equipment, and miniature aerials, so comparatively diminutive that they may be placed on a lecture platform.

Comments on Trans-Atlantic Wireless Telegraphy.—The Great War interfered materially with the free use of wireless telegraphy and during the term of the war the governments of the various nations of the world exercised complete control of its operation over land and sea. The following remarks concerning the status of trans-Atlantic Wireless telegraphy are drawn from an article in the 'International Cable Register Supplement,' by E. B. Pillsbury.

Regular message traffic has been transmitted between Europe and America by Wireless telegraphy continuously for over eight years by means of a duplex circuit between Clifden, Ireland, and Glace Bay, Cape Breton, that is, messages between those points are transmitted in either direction simultaneously. The transmitting and receiving apparatus are not placed in one station but in separate stations a number of miles apart, connected by land lines,
which make it possible to localize the sending and receiving operators in the one room. The receiving instruments are coupled to two distinct aerials, one of which is used for receiving while the other, known as the balancing aerial, is so arranged that it is practically unaffected by the signals from the distant station from which it is expected to receive. The effect produced by the balancing aerial on the receiving apparatus by the adjacent transmitter is equal and opposite to that produced thereby through the receiving aerial which is tuned to the wavelength of the signals it is desired to receive. The latest type of the Marconi receiving apparatus greatly minimizes the atmospheric interference to which wireless transmission over long distance was particularly exposed in the early days. The signals arriving in Glace Bay from Glidden are as a rule easily read through any ordinary electric atmospheric disturbance. The strengthening of received signals has made possible the employment of recording instruments which not only give a permanent record of the received messages, but are also capable of operation at a much higher rate of speed than would be obtainable by an operator receiving by sound or sight. The method employed for this purpose is to insert into a gramophone the wireless telephone whereby the received dot and dash signals are impressed on the wax cylinder. These signals may then be recorded at maximum speed and afterward be removed to another gramophone that may be speeded down to the capacity of the receiving operator. A high rate of transmission of signals is attained by the use of a Wheatstone automatic transmitter (see TELEGRAPHY) using perforated paper tape.

While the war has interrupted the free use of wireless telegraphy and telephony it has at the same time made demands upon the engineers of this country and Europe in the direction of improvements in these arts that have no doubt produced practical results that would not otherwise have been forthcoming in years. This has been remarkably true with regard to the improvements in vacuum-tube apparatus and the results obtained thereby in the service of the United States Signal Corps. For this service alone the production of high quality standardized tubes has been at the rate of over 1,000,000 per annum. For interesting data on this subject consult a lecture given by Maj.-Gen. George O. Squier before the American Institute of Electrical Engineers, 10 Jan. 1919, on "Aeronautics in the United States from the Beginning of the War to the Present Time."

Marconi Wireless Telegraph Station at Belmar, N. J.—The building shown in the foreground is the operating-room of the station. It is over 82 feet in length. This station is intended to communicate with the high power station at Carnarvon, Wales. The mast shown are 300 feet in height and extend westward one mile from the shore. The room containing the receiving apparatus is over 80 feet long. The messages received and transmitted from this station are sent to and from the Marconi offices in New York, London, and Paris. Similarly, messages are received and transmitted to and from the Marconi office in London to the high power station at Carnarvon.

Proposed Pan-American Wireless Chain of Stations.—It has recently been announced that the longest wireless station in the world is to be constructed near Buenos Aires, South America. This will be one of a series of wireless stations designed to connect the United States with all the important countries of South America, including Argentina, Brazil, Uruguay, Chile, Peru and Ecuador. Mexico and Cuba are also to be placed in wireless communication with these countries. The South American wireless system will connect at New York with trans-Atlantic wireless to Great Britain, Scandinavia and Russia and at San Francisco with the Hawaiian Islands and thence with the Orient. In the United States the system will...
with the 25,000 stations of the Western ad lines.

rials of the proposed station at Buenol will be supported by self-sustaining corresponding the towers of the station at Arlington, Va., which are d in the accompanying illustration. details of this projected chain of wire will be found in The Wireless g of Telegraphy.—Proceedings of Institute of engineers; Bucher, E. E., Practical Telegraphy and Vacuum Tubes in Communication; Fleming, Principles c-Wave Telegraphy; ib. Elementary of Radio Telegraphy and Radio Tele- Maver, William, Jr., Wireless Telegr Telephone. 1

WILLIAM MAVER, JR., Author of 'American Telegraphy'.

[Samuel, Count, African ex- Baromberke, Eastern Transylvania, March 1916. He won a distinguished the roll of African explorers by his of 1886-89, during which Lake ferd in size of the great lakes of Africa, was for the first time sighted men. The existence of a great lake known area between the Victoria and Abyssinia had for some years been and after the route in this direction 1 opened up by Joseph Thomson's through Masaill, Count Teleki was to take advantage of this open road. only made his way to the lake, but to its northern extremity, bringing usable observations on the geography, and ethnology of the country traversed. various subsequent journeys in Africa East, but resulting in no further ical discovery.

2MACHUS, tɛməkəs, in the Ho- war cycle, a son of Ulysses (q.v.) hope. He was still in the cradle when he went to the Trojan War. When his 2d absent from home about 20 Telemachus was urged by Athena 1, to appear to him in disguise a, a friend of Ulysses, to go and seek is the place of his residence and the his long absence were then unknown, l the courts of Nestor and Menelaus to form. He afterward returned to here the suitors of his mother, Penel- conspired to murder him; but he heir treachery. His father had arrived and two days before him, and was then use of Eumaeus, a faithful servant. us is the hero of Fénélon's famous 'Les Aventures de Télémaque' from e word Mentor has been adopted erial use. See Télémaque.

3MACHUS, a Syrian monk, who, in of the Emperor Honorius, about 400 ed into the arena of the Coliseum and l to separate the gladiators. He lost the hands of the enraged populace, occurrence is said to have influenced to discontinue gladiatorial combats, did soon afterward.

Maque, a romance by Fénélon. e is in form a novel, and relates stories of Telemachus in search of his father, Ulysses. In its flowery poetic style, however, and in its division into 24 books, it suggests the epic poem rather than the modern novel. It is based upon the Odyssey of Homer, and uses the mythology and introduces many of the characters of that poem. Its intention was primarily didactic. It was one of several works that Fénélon wrote for the instruction of the young Duc de Bourgogne, grandson of Louis XIV, whose tutor he was (1663-65), by his experiences and observation during his wanderings, in various lands and among different peoples, aided especially by the wise comments and interpretations of Minerva, who accompa- nies him in the form of Mentor, the young Telemachus, future ruler of Ithaca, and through him the future ruler of France, received those lessons on the proper conduct of life and especially on the duties of a king and on sound principles of government, which were calculated to prepare them for the responsibilities of their high stations. It is a striking mark of the honesty and independence of Fénélon that these lessons are singularly liberal and modern, and contain implicitly some axioms of the government and policies of Louis XIV. 'Télémaque' has often been translated into English. Arthur G. Canfield.

TELEMETER, any one of various instruments designed to measure the distance of objects more or less remote. It is used by surveyors and engineers, wherever rapid work is necessary and a fair amount of accuracy required, on the battlefield to determine ranges, etc., where it is usually called a range-finder. One form is a recording apparatus electrically connected with a distant meteorological or other instrument. The surveyor's telemeter is better known as a stadia, and consists of a mounted telescope with horizontal cross-wires, which, when in use, intercept the divisions upon a graduated rod held by an assistant at the distant point. The reading multiplied by the factor of the instrument gives the distance.

TELECEPHALL, that is, (Gr. τέλεος) complete (Gr. κεφαλή) head. A name applied by some authorities to a group of fishes embracing most of the teleosts, or true fishes, especially those bearing a full complement of cranial and opercular bones, with the anterior vertebrae separate.

TELEOLOGY (Greek, telos, 'end' or 'purpose') denotes a mode of explanation in accordance with which the world as a whole, or particular forms within it, are regarded as due to the realization of some end or purpose on the part of some intelligence existing either in the world or outside it. Thus we might account for the various arrangements of the physical universe—the distribution of land and water, the movements of the heavenly bodies, the changes of the seasons—by referring them to some end that the governing power of the universe is thereby achieving, as, for example, the preservation and comfort of mankind. Or we might explain the structure of an organism or of any of its parts by reference to the purpose that it serves, as, for example, the presence of fish in the sea through their usefulness to man as food, or the structure of the eye through its service that it renders. It is natural to assume that everything has been made for man and to
regard all things as existing for his service and convenience, that "even the cork-trees," as Hegel remarked in satirizing this view, have been produced in order that we may have stoppers. The doctrine of teleology does not always adopt this narrowly anthropocentric point of view. But the very essence of its procedure is to postulate the existence of some intelligible ends or purposes in the world, and to read the various natural phenomena by reference to these ends. It is thus explained in terms of final causality, rather than in terms of efficient causes or mechanism. Teleology seeks to make things intelligible by showing their relation to an end that is being realized; it answers the question "Why?" or "For what purpose?" Mechanism, or explanation by efficient causes, on the other hand, knows nothing of a purpose. It shows how the result has actually been produced by the operation of natural causes, acting according to invariable laws. It explains by answering the question, "How?" It is well known that there has been a constant conflict, throughout the whole history of thought, between teleological and mechanical modes of explanation. Indeed, this may be said to be the supreme question at issue in all philosophy. Is the world and all that it contains merely a natural product of efficient causes acting without any intelligent guidance, or is there some purpose or system of purposes being realized?

The terms in which the conflict between teleology and mechanism are expressed have been modified in recent times, and it is perhaps well to note some fundamental differences between the thought of the present time and the earlier mode of conceiving teleology. The older teleology regarded God (or the gods) as a being outside of the world who in an external way was accomplishing some purpose through it, as the mechanic uses a machine to accomplish his purposes. From the modern point of view, God is identical with the ultimate principle of things. The purpose of the world, if any intelligible purpose exists, is not something superimposed on it from without, but an inner or immanent purpose to which it naturally and everywhere gives expression. The general ac

rather true that as mutually complementary conceptions they presuppose each other. Modern teleology admits to the full the rights of mechanical explanation in every field. But it insists that the fact of the existence of the world is a matter of our intelligence demand that we shall everywhere go beyond this standpoint and recognize an underlying system of purposes in the world-process. The two modes of explanation are thus on different planes, and opposition between them on this account is not the result of any clash of the faculties of our mind.

As Lotze says: "The true source of life is to be found in showing how absolutely universal is the end, and at the same time how completely the significance of the mission which mechanism has to fulfill in the structure of the universe.

Both a mechanical and a teleological view of the world was developed by Greek philosophers, the former by the Atomists, of whom Democritus is chief, the latter mainly by Plato and Aristotle. The Atomists united with the general spirit of the Christian doctrines, made the teleological the prevailing mode of explanation during the Middle Ages. The pioneers of modern thought, — Galileo, Bacon, Descartes, Gassendi, Hobbes, Spinoza, — worked out the mechanical theory, making it a powerful instrument of research by basing it on exact mathematical principles. They were strongly opposed to teleology, which they regarded as entirely unable to furnish scientific explanations of natural occurrences. Leibniz was perhaps the first thinker in modern times who saw that teleology and mechanism can be reconciled by properly distinguishing the planes where each principle has its valid application. For Kant (whose treatment of teleology is very important), mechanism is the only principle that we can confidently apply in science as objectively determining phenomena. Teleology, on the other hand, although a necessary subject for thought when we are dealing with organic phenomena, cannot be given a valid application. Living things must appear to us as if they were determined by some end, but we can never say that this purpose is actually present outside our minds in the objective phenomena themselves. At the same time, while mechanism is and must remain the sole principle of determination in the phenomenal world, Kant teaches that we are obliged to postulate a world of noumenal or more ultimate reality where teleology, by recognition of a moral purpose in the world, becomes the final determining principle. (See also MECHANISM, Consult Adler, Max, "Kausalität und Teleologie im Streite und die Wissenschaft" (in Marx Studien, Vol. I, Vienna 1904); Bosanquet, B. A., "Meaning of Teleology," in the latter think of the British Academy, London 1906); Enard, Franz, "Mechanismus und Teleologie" (Leipzig 1890); Janet, Paul, "Final Causes" (Eng. trans. by W. Atlee, New York 1883); Windelband, "History of Philosophy," History of Modern Philosophy, Stuttgart, Ethics (Appendix to Part 1); Kant, "Critique of Pure Reason" (latter part of "Transcendental Dialectic"); "Critique of Judgment" (Second Part); Shoup, "Mechanism and Teleology" (1901). For Professor of Philosophy and Dean of the Graduate School, Cornell University.
TELEOSAURUS, or TELESAURUS, an extinct genus and family of croco-
(T. cadomensis) found in Mesozoic de-
See Crocodile, Fossils.

OSTOMI. See Ichthyology.

LEPATHY, the transfer of thought
one mind to another at a distance, es-
by the sending and receiving of definite
information from the mind of one
person to the mind of another person, beyond
reach of any of the five senses, without
mechanical aid. The sympathetic con-
mind of mind with mind is more or less ap-
plies to all, but whether this can be expanded
the full extent of the definition is doubted
by physicists, and regarded as not proven.

Within recent years, the study of
knowledge, spiritual mediumship, hypnot
mind-reading and thought transference
have led some eminent scientists to
it themselves definitely to accept with
such phenomena. It appears also that all
sages, yogis, theosophists, clairvoyants,
impy mediums, and seers believe in telep
and many of them have written volumes on
these subjects and those of which they
made record.

ere is seemingly no end to records of ex-
cesses of individuals which go to prove
thy, but these records, to be found in every
library, have no effect on the mind of the
sages who insist that he be shown — that
made apparent to one of his five senses that
thing exists. In the very nature of the
ought to be apparent that communica-
y means outside of the five senses cannot
ought and put upon a table and exhibited
benefit of people who want to see and
em. The evidence can come only from
people who have developed their powers
and thought to the extent of being able
t from a telepathic communication,
t send or receive one, or both.

Even a sender may have to depend much on
by the receiver, and the receiver on
racy of the sender, as they put together
periences, to obtain the proof of telep
ists. Those persons conclude that they
had telepathic communication, and tell
about it they are sure to be discredited
st of their acquaintances, who conclude
ese things are hallucinations. No physi
physical proof as yet can be adduced of
periences. If telepathy be a fact, and
on after death, it should be possible to
icate telepathically with the dead. And
just what spiritualists and many psychi
earches believe happens. It is a curious
that those who doubt communication with
ates intelligences, as by the Ouija board
ough a medium, are always claiming that
omena are probably produced by the
of some one who knows the facts of
ssages and influences the medium. Ob-
if mind can act on mind, telepathy is a
ad should furnish a bridge for communi-
between the world of the dead and the
And that is exactly what Sir Oliver
Camille Flammarion, Cesare Lombroso,
Doyle and other people of great intelli-
ave been trying to inform the public for
years. But because the evidence
cannot be handed out like a Sunday newspaper,
or put into a receipt so that anybody can tele-
path, the "material scientists" have largely re-
fused credence. Their attitude is changing,
however, and largely through the work of the
Psychical Research Society, which was started
with the idea (in many minds) of wholly dis-
proving spiritualistic phenomena, and has after
35 or 40 years convinced probably all of its active
members that the dead live on, and that more or
less communication is all the time taking place
between the two worlds. It was under their
auspices, a few years ago, that Prof. Henry
Sedgwick investigated 17,000 cases of appar-
tions of dead persons seen and recognized by
friends at a distance at the time of decease.
He reported that the result showed "coin-
cidences" 440 times as numerous as they should
have been under the law of chance.

Thought is a power, as is seen when great
orators sway audiences, or as history discloses to
us through the progress of an idea; hence it
is logical that thought should be able
to manifest itself at a distance, as do the
vibrations in radiography. For success in telep-
athy two minds in rapport are required, or
as the radiographer would say, the two minds
and it seems that these minds usually must belong
to egos sufficiently advanced that they know
they possess minds that they can control, and
who have practised this control until they can
concentrate on a given thing for a period of
many minutes, in some cases hours. Having
acquired this power of concentration, the telep-
ather must then send a definite sharply de-
defined thought to a receptive individual, or one
who is in known harmony, and preferably who
has arranged to have his mind receptive at
a given time. The message sent should consist
of concrete ideas rather than specifically formed
sentences in words. Probably meaningless
bers are the hardest things to convey telepathi-
cally, and yet members of the Psychical Re-
search Society met with considerable success
in sending numbers, and a lady of the writer's
acquaintance found the combination of a safe
and opened it, though previously she knew so
little about safes that she did not think that
the knob was to be turned alternately to the
right and left. Consult 'Proceedings of the
Society for Psychical Research'; Besant,
A., 'Thought Power' (1900); Rider, F., 'Are
the Dead Alive?' (New York 1909). See
Hypnotism; Psychical Research.

CHARLES H. COCHRANE.

TELEPHONE, The. Introductory.—The
word "telephone," derived from the Greek,
means "a voice from afar." Although the word
has sometimes been applied to non-electrical
devices for conveying sound by vibra-
tions, transmitted through tightly stretched
strings or wires by means of diaphragms con-
ected thereto, the term has now generally come
to mean the electric speaking telephone. In
all electrical telephone systems the acoustic
waves of condensation and rarefaction, set up
in the air by the speaker's voice, are directed
against the diaphragm of a transmitting instru-
ment. This transmitter converts these acoustic
waves into electrical waves of the same fre-
quency and shape. The latter travel as an elec-
tric current of varying strength over the tele-
phone line to the receiving instrument. In the
receiver the electrical waves pass through a coil on a magnet. The varying field of magnetic force which they produce causes motion of the iron diaphragm of the receiver, acting as the armature of the magnet. The motion of the receiver diaphragm sets up acoustic waves in the air, similar in frequency and form to the waves produced in the air at the sending end by the voice of the speaker. These acoustic waves, impinging upon the ear of the person at the receiving end of the line, reproduce the words of the speaker. (Fig. 1).

Invention of the Telephone by Professor Bell.—Not only is the use of the telephone greater in America than in any other portion of the world, but telephony is notably an American art. The telephone was invented in America by Alexander Graham Bell and substantially all of the important contributions to the development of the telephone art have been made by Americans. Professor Bell was a teacher, at Boston University, of a system of visible speech for deaf mutes, devised by his father, who had studied the science of acoustics. Father and son had made together numerous researches into the relations which existed between the different elements of speech, and the musical relations of the vowels. Professor Bell was a close student of the researches of Helmholtz, and his studies of the latter’s experiments concerning the artificial reproduction of vowel sounds by means of electric tuning forks led him into the study of the application of electricity to acoustic instruments. While teaching at Boston University, Professor Bell occupied his spare time in efforts to realize his dream of the telephone, and also in experimenting upon a system of harmonic telegraphy designed to send several differently tuned, and therefore, non-conflicting telegraph messages, over a single wire at one time. While experimenting on the harmonic telegraph, Professor Bell had before him continually a vision of transmitting speech electrically. In the summer of 1874 he made a sketch of his conception of a speaking telephone which, although not tried that at time, became a part of, and was shown in, his first patent of 7 March 1876. (Fig. 2).

His conception was that the vibrations of the air produced by the voice speaking into mouthpiece A would cause membrane D, connected to steel reed C, to vibrate, thus inducing an undulating electric current to flow from coil B, over line E, through coil F at the receiving end to ground. This would cause the steel reed at the receiving end to vibrate and to transmit its vibrations to the receiving membrane I, causing the latter to produce air waves corresponding exactly to those formed by the voice at the sending end.

On 2 June 1875, while experimenting with harmonic telegraph, a demonstration of a principle on which he had based his speaking telephone of 1874 was successfully performed for him. In tuning the harmonics (Fig. 3) it was Professor Bell’s habit to snap the reed closely to his ear to determine the frequency of the tuning. While doing this he startled to hear the twang of the vibrating steel spring. Going quickly to the semi instruments in an adjoining room, he found his assistant, Mr. Thos. A. Watson, had one of the springs in order to free it from its spring that Professor Bell had him snapped spring having generated an alternating current in the coils of the semi instruments in which traversing the line and passing through the reed caused the sound to be reproduced. (Fig. 4.)
Fig. 11 — Box Telephone. Cover Removed. Made in June, 1877. Equipped with a sheet iron Diaphragm and the Watson Hammer Signal or "Thumper." First form of telephone equipped with a signalling or calling device. This instrument was used interchangeably as transmitter and receiver.

Fig. 10 — Box Telephone. First Style

Fig. 15 — Bell Box Wall Telephone, August, 1877, with pole-pieces and mouthpiece at right angles to the magnet. This first commercial form of wall telephone was used both as transmitter and receiver.

Fig. 12 — Cross-section of Wooden Hand Telephone made in May, 1877, frequently called the "Butter Stamp" receiver. First commercial form of Bell Hand Telephone. Used both as a transmitter and receiver.

Fig. 14 — Cross-section of modern Bi-polar Receiver
Fig. 18 — Cross-section of Blake Transmitter

Fig. 19 — Blake Transmitter, open

Fig. 24 — Magneto Telephone Ringer or Call Bell, invented by Thomas A. Watson in 1878. Used in the first commercial Bell subscribers' sets

Fig. 25 — Phone Generator

Fig. 28 — Early form of Telephone with automatic Hook-switch

Fig. 29 — Modern Desk Set with automatic switchhook
I do the same for any sound, even that of my own voice. On the next day he gave instructions for the making of his first real telephone, known as the Galloway type, (Fig. 4). It consisted of a frame of wood carrying an electromagnet with a copper coil and an iron armature, the free end of which was fixed to the centre of a small drum head of the type used in telegraphy. A mouthpiece was provided for speaking purposes. With this instrument, the sounds were transmitted over a short distance and heard by means of a second instrument at the other end.

Professor Bell was then experimenting with his liquid transmitter, (Fig. 5). This instrument consisted essentially of a diaphragm, at one end of which was attached a small condenser, and at the other a liquid, which was able to be vibrated by the voice, to the sound of which a receiver was provided. The liquid was contained in a small cup, and the diaphragm was held by a small spring. The transmitter was connected in series with a battery and a tuned condenser receiver, (Fig. 6). Undulating waves were produced by the change in resistance of the circuit as more or less of the liquid was immersed due to the vibration of the diaphragm. With these instruments, Professor Bell speaking, and Mr. Watson listening, the first complete articulate telephone message was transmitted.

On 9 Oct. 1876 the first reciprocal conversation took place over an outdoor wire, two miles long, between Boston and Cambridgeport, Mass. The instruments (Fig. 7) had, as diaphragms, thin iron discs which responded to the voice vibrations. Close to, but not touching, the centre of the diaphragm was the core of an electromagnet, the windings of which were connected in series with a battery, the line and a similar instrument at the other end. With these instruments was carried on a sustained conversation which was fully reported in the next morning’s papers as the latest startling scientific achievement.

Professor Bell exhibited his telephone inventions at the Centennial Exposition in Philadelphia in 1876. There he demonstrated, before the judges of the exposition and a large number of people, the mechanical action of his open circuit instruments.
of people, his liquid transmitter (Fig. 5); iron box receiver (Fig. 8); single pole membrane telephone (Fig. 9), and other types of instruments. As a result of this exhibition of the telephone its fame spread rapidly.

Work of Early Investigators Preceding Bell.—The idea of applying electricity for the transmission of sound arose as soon as the effects of electric telegraphy were observed. Page, in 1837, discovered that a magnetic bar could emit sounds when rapidly magnetized and demagnetized. Electric vibrators devised by Macaulay, Wagner and Neef and adapted to produce musical sounds by Froment and Petrini in 1847 to 1852, showed that the transmission of sound to a distance was not impossible. Bourseul, in 1854, suggested that if one spoke near a movable disc sufficiently flexible to lose none of the vibrations of the voice, this disc, by alternately making and breaking the current from a battery, might cause another disc, at a distance, to execute the same vibrations simultaneously. Reis, in 1870, invented a musical telephone that, by alternately making and breaking an electric circuit, could transmit musical tones over a wire to a distant point. Reis' work, although urged as an anticipation of Bell, never found favor in the courts during the extensive patent litigation that followed Bell's invention because his scheme was based on making and breaking a current, which cannot transmit speech. The United States Supreme Court said "to follow Reis is to fail, but to follow Bell is to succeed." The publication of Professor Bell's invention brought forth many claimants to priority. After years of litigation in which the state of the art and the claims of others were considered exhaustively, priority for the invention of the telephone was finally awarded to Professor Bell. While Professor Bell, by means of lectures on the telephone, was arousing public interest in his invention, development work was begun to make the instruments more practical for general use. The box type (Figs. 10 and 11), which was the best form thus far devised, was not adapted to be held in the hand. The inconvenience of the box telephone led to the development of a style of instrument which could be held in the hand readily and used for transmitting or receiving as desired.

The Receiver.—Several forms of receiver (hand telephone) employing wood for the containing case were produced and placed in public use in the early days. Fig. 12 illustrates one of these. This type was subsequently improved in design and hard rubber replaced wood for the handle and ear-piece. (Fig. 13). Thus far the receiver had one pole-piece and coil placed on the end of a permanent magnet. In 1890 the first type of receiver having two pole-pieces and coils was developed. The bi-polar receiver has passed through a long period of evolution, each successive step in the development increasing its talking efficiency or improving the mechanical features of its design. Fig. 14 shows the bi-polar receiver in use at the present time in the Bell System. Two permanent magnets are used. To their poles are welded soft iron pole-pieces which constitute the cores of the electro-magnetic coils. The supportin of non-materi welded magnetic cores, thinning a rig which is ed within rubber, ca ear cap-

card diaphragm ly in plac e, but not ing, the pieces. Each is carefully edmate manufactured extremely rate dime and the w assembled tested with utmost order the s instruments greatest able eff and mec strength is secured over 50 di types and for use in the Bell System. Practically these have been abandoned in favor latest improved type. While great in terms have been made in the design efficency of the telephone receiver, its mental electrical principle is the same as who invented it.

Out of Bell's several of useful transmitters coming of on the hand type of mitter. Several type receivers were growing in the principle differing what in of constant are uses. The hand mitter was sha develop into the magneto box transmitter 15). Except for very short lines, this type of transmitter was not sufficiently ful. The solution of the vitally impor-

Fig. 13.—Cross-section of improved Hand Telephone, with hard rubber of receiver handle and ear-piece.

Fig. 16.—Early form of Berliner Transmitter.
Emile Berliner invented a transmitter (Fig. 16) having, in contact, two pieces of carbon, the other capable of being moved by the voice. The principle was that two bodies in contact and forming an electric circuit, if the pressure on one was increased, the electrical resistance of the circuit is diminished and more current flows. Hence, the diaphragm of the voice, which is a metallic diaphragm capable of being vibrated by the voice. This diaphragm is in contact with a metal ball, and the metallic contact is at a. Vibration of the diaphragm, as explained above, causes corresponding changes in the current flowing in a circuit including the contact, a battery, the line, and the receiving instrument. In later forms of transmitters, carbon contacts were used instead of metal.

Edison invented a transmitter (Fig. 17) in which the current varies with the motion of a varying element containing a small disc of carbon (lamp black) between two electrodes arranged so that the current varies with the resistance of the carbon. In 1878, Francis developed an improvement in the Edison transmitter. He employed a platinum point against a hard carbon surface. Fig. 18 shows a section of a Blake transmitter. The platinum point is forced against the diaphragm by a spring. The voice is applied to the diaphragm, causing it to vibrate. The platinum point is forced against the diaphragm, and the voice is transmitted through the air.

In 1880, an English clergyman, Henry Hunnings, invented a transmitter employing granular carbon to secure a large number of points of microphonic contact. The essential feature was a thin platinum diaphragm in contact with a mass of granular carbon enclosed within a chamber having at the rear a plate of metal or carbon in contact with the granular carbon. In 1885, Bell engineers improved the Hunnings transmitter (Fig. 20) by using a horizontal platinum diaphragm and a gold-plated electrode dipping into the granular carbon. While this transmitter operated well when at its best, after being used for some time the large quantity of granular carbon produced an insensitive condition that seriously affected its efficiency.

To overcome this, A. C. White, in 1890, working in the Bell laboratories, invented the solid back transmitter (Fig. 21) in which the contact element is in the form of a small chamber (termed the "button") containing two carbon discs electrodes; one fixed, the other free to vibrate. These electrodes are separated by a small space partially filled with granular carbon. The fixed electrode is rigidly supported by the solid backing afforded by a stout metal bridge. The movable electrode is firmly attached to the centre of the diaphragm. The function of the granular carbon is the same as in the Hunnings type but the defects of the latter are overcome. This instrument has proved so perfect in its operation and so satisfactory in its general design that it has formed the basis of all the best types of transmitters.

A number of modifications from the original design have, however, been made to improve its electrical and mechanical features. Fig. 22 shows the construction of the "button" of the modern common-battery solid back transmitter. Over 70 different types and styles of transmitters have been developed and placed in service by the Bell system. Practically all of them have been displaced by the type just described. Transmitters employed by independent companies operate on the same general principle as the type just described.
described and resemble it in appearance.

The Induction Coil.—Coincidently with the introduction of the variable contact (microphone) transmitter came the application of the induction coil to the telephone. Fig. 23 shows the original telephone circuit and two important steps in the evolution of telephony whereby it became possible to talk over greater distances than formerly. In the simple magneto telephone circuit $A$, the amount of electrical energy transmitted depended on the ability of the telephone, when spoken into, to generate a current independent of any outside source. This current was limited in strength to the small amount obtainable from the vibration of the diaphragm by the voice. $B$ in Fig. 23 shows a circuit in which the variable contact transmitters, the receivers, the line and the source of energy (battery) were connected together in series. With this arrangement better results were obtained, the extent of improvement depending on the voltage of the battery, the conductivity of the line and the current changing capabilities of the transmitter. In this circuit the transmitter acted as a valve to vary the energy furnished by the battery. $C$ in Fig. 23 shows the use of the induction coil, the latter consisting of a bundle of iron wires surrounded by two separate wire windings. Each transmitter is placed in series with a battery and the primary winding of an induction coil consisting of a few turns of large wire. The secondary winding of the induction coil, consisting of many turns of relatively fine wire, is connected in series with the line and the receivers. Placing the transmitter in a local circuit, independent of the line circuit, permitted the use of a low voltage battery and allowed the variation in resistance produced by the transmitter to be large in comparison with the total resistance of the primary circuit. The induction coil operates as a transformer. The relatively large variable current at low voltage in the primary circuit is transformed into a small current at high voltage in the secondary circuit by reason of large ratio of the number of turns in the secondary winding to those in the primary winding. The secondary current traverses the line with less loss than would be the case if current were of lower voltage but larger.

Signalling Systems.—When the box telephone was first employed, the custom was to tap on the diaphragm with a pencil as a method of calling the party at the other end of the line. Later this was superseded by a hand-operated hammer mechanism which gave a vigorous blow on the diaphragm that was transmitted telephonically to the station at the other end of the line (Fig. 11). Tap bells were also employed for signalling as were ordinary electric vibrating bells and telegraph sounders. The need for a reliable and efficient method of signalling was realized at an early date and Watson developed a ringer and magneto-generator to meet this need. The ringer (Fig. 24) consisted of an electro-magnet having a central pivoted polarized armature carrying the wire.
which played between two gongs. Polarizing the armature made it responsive to the reversals in polarity of the magnet when alternating current passed through the coils of the latter. To furnish the alternating current, a small electric generator (Fig. 25) was provided, consisting of a powerful permanent magnet carrying an armature capable of being rotated by a wheel which the calling party turned by means of a crank. Figs. 26 and 27, in diagrammatic form, the principles of the latest types of generator and ringer.

**Automatic Switchhook.** It was early apparent that some means should be provided for switching, to and from the line, the signalling and talking circuits at the substation whenever it was desired to do so. At first, hand-operated switches were used for this purpose but it was soon found desirable to make the switching operation automatic, as users would frequently leave the hand-operated switch in the wrong position. To attain this end, a lever switch was invented by H. L. Roosevelt. The switch was operated by the weight of the receiver. Fig. 28 shows an early set arranged to accomplish the desired purpose. The hook-switch, in its downward position, left the circuit free for the incoming signal; in its upward position, which it assumed when the receiver was removed from it, the necessary contacts for talking were closed. Figs. 29 and 30 illustrate the switchhook arrangement for the present telephone. Figs. 31 and 32 show the circuits controlled by the switchhook for a standard magneto and common-battery substation circuit respectively.

**Series and Bridging Bells.** In the early days, after the development of the magneto-bell, it was the practice, on party lines, to connect the sets in series, as shown in Fig. 33. To enable the ringer to operate effectively it was necessary to provide it with a large number of turns of wire. As a result these ringers possessed considerable impedance, i.e., they offered substantial obstruction to the telephone current, seriously affecting the service between any two talking stations. The more ringers in the circuit, the poorer was the talk. To improve this condition, in 1889, John J. Carty, who at that time was known as one of the chief technical experts, and who has since become the rec-
recognized engineering leader in telephony, invented the bridging bell. In this arrangement (Fig. 34) the bell, or "ringer," has a high impedance winding which, while responsive to the relatively low frequency ringing current, does not permit the talking current to pass over the ringer circuit, but does allow it to pass over the line from one station to another. It was this invention which made possible the successful use of party lines.

Switchboards.—If its use had been restricted to isolated lines only, the telephone would undoubtedly have remained scarcely more than an interesting scientific curiosity. With the development of the instruments themselves, the necessity for connecting one telephone station with another, by means of some switching device, at once became apparent.

The first interconnection of telephone lines by means of a switchboard took place at Boston in 1877. A few burglar-alarm lines were equipped at the station ends with box telephones. At the burglar-alarm office, each line was connected to a small metal block. These blocks were so arranged, in relation to other metal blocks placed closely beside them, that metal plugs could be employed to connect the blocks together in various ways, thus permitting the lines to be interconnected as desired (Fig. 35).

The first commercial switchboard was provided with an electromagnetic annunciator shutter or index of which moved, when a subscriber operated the magneto-generator at the station, thus attracting the operator's attention to the fact that a connection was desired. This shutter operated each subscriber's line was also connected at

Fig. 34.—Party Line Circuit with Bridging Bell.

Fig. 35.—First Telephone Switchboard. Used in New Haven, Conn., for eight months.

Fig. 36.—First Telephone Switchboard. Used in New Haven, Conn., for eight months.
Fig. 51-B — Cable Loading Coil and Section. Wire Core Type

Fig. 52 — Underground Manhole showing Pots containing Loading Coils, and connections from coils to cables

Fig. 53 — Loading Coils in Iron Cases connected to an Open Wire Line

Fig. 54 — Cross-section of 1200 Pair Cable

Fig. 55 — Vacuum Tube Repeater Bulb and Socket
switchboard to a device known as a "spring-jack." The insertion of one plug of a connecting cord into the spring-jack associated with the line of the calling subscriber and the plug at the other end of the same cord into the jack of the line of the called subscriber, placed these subscribers in connection so that they could talk with each other. The cords were provided with listening and ringing keys. The former enabled the operator to communicate with the calling subscriber to ascertain the line with which connection was desired. The latter permitted the operator to send alternating current over the called line for the purpose of ringing the called subscriber's bell. An electromagnetic disconnect annunciator in each cord circuit enabled either subscriber, by operating his magneto-generator, to signal to the operator that the conversation had ended.

![Fig. 39.—Simplified Circuit Diagram of Series Multiple Switchboard. (Operator's telephone shown connected for "busy test").](image)

Switchboards of this general type were used until the number of lines terminating in a telephone central office had grown so large as to exceed the ability of one operator to complete all of the connections. This situation was met by placing two or more switchboards side by side, the operators completing the connections by reaching across, with their flexible cords, from one board to another. As the number of sections of switchboard placed side by side increased still further, the distance to which an operator could reach was exceeded. The next step was to join the sections of switchboard by metal strips or wires. An operator could then connect a calling subscriber with a certain strip and request another operator, more conveniently situated, to connect the called subscriber to the same strip. These strips constituted the first use of the so-called "trunk line" between switchboards. The practice led to much confusion, due to the operators calling out the desired numbers, and resulted in the development of means enabling the operators to communicate along the switchboard by telephoning one another. This type of switchboard was known as the "transfer" board. As the number of lines grew, it gave less satisfactory service and it was seen that, unless something better was developed, the switchboard would be a serious limitation on the growth of the business. The solution was found by multiplying the points of access to each subscriber's line so that a means of access (spring-jack) to each subscriber's line in the office appeared in the face of the switchboard within reach of every operator, thus obviating the necessity for trunking calls between operators in the same office. The switchboard in which this "multiple" principle was first used was known as the "series multiple" board. The invention of the multiple was made by L. B. Firman. A simplified diagram of the wiring of this board is shown in Fig. 39, which also illustrates the construction of the spring-jack. In this ar-
was required to touch the tip of the connecting plug against the ring of the jack with which connection was desired before completely inserting the plug into the jack. If the desired line was already in use, the potential on the ring of its jack would cause the operator to hear a "click" in her head telephone, thus indicating that the line was already in use through a connection established at some other part of the switchboard. These two very important principles—the multiple and the busy test—have persisted, in one form or another, in every large switchboard up to the present time. A serious objection to the series type of board was that dirt or dust, accidentally lodging in the spring jack contacts, would introduce high resistance into the line, or even cause the circuit to become open, thus interfering with or quite preventing conversation over the line. Another objection to the series board was that the circuit in the switchboard was unbalanced. To overcome these defects Scribner, applying Carly's bridging principle to switchboards, devised the "branch terminal" multiple board. (Fig. 40). With this arrangement of circuits, two wire system, the switchboard had to be adapted throughout to the new plan of working. This meant a wholesale displacement of existing grounded line switchboards by boards of the new metallic circuit type.

For a long time after multiple switchboards came into use, batteries were required at each telephone station to furnish the current for actuating the transmitter, and magneto-generators, operated by turning a crank, were employed for signaling the central office whenever a connection was desired. The generator was also used for signaling "disconnect," and was not wholly satisfactory for this purpose, as subscribers frequently neglected to give the disconnect signal, making it necessary for operators to "listen in" on connections and ask "Are you through?" The invention and development of the common battery system did away with the batteries and magneto-generators at the telephone stations. With this system the only battery required was a large centralized or common storage battery at the central office. This system, furthermore, did away with all mechanical line and disconnect signals in the switchboard, by enabling tiny electric lamps, governed by relays, to be substituted for them.

This was one of the most important improvements ever made in telephone switchboards. The subscriber, connected with a common battery board, calls the central office by merely removing his receiver from the hook, the motion of the latter causing a lamp associated with his line to light before the operator. Completion of the conversation is indicated to the operator by suitable lamp signals in the cord circuit, when the receiver is replaced upon its hook. The circuits of common battery switchboards are of two types—the impedance coil type and the repeating coil type. Fig. 41 shows a typical circuit diagram of the latter type, which is the more generally employed. Fig. 42-A shows the front view of a modern common-battery switchboard. The operators sit on

![Fig. 40.—Simplified Circuit Diagram of Branch Terminal Multiple Board. (Operator's telephone shown connected for "busy test").](image-url)
n front of the switchboard. Fig. 42-B is a detail of a single position. Where the operator is the unit of service, the subscriber's line is provided, at the central

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the operator at the distant office (known as the "B" operator). The number of the desired line is then transmitted over the call circuit to the "B" operator, who, by visual inspection, selects an idle trunk line and transmits back its number to the "A" operator, who at once connects the calling party with that trunk line, the "B" operator meanwhile establishing connection between the other end of the same trunk line and the line of the called party. The call circuits are used for no other purpose than communication between operators.

Trunk circuits have been designed, and are in general use, which allow the "A" operator to supervise a connection completed in a distant office as readily as would be the case with a connection completed in her own office. The same is true of machine ringing circuits whereby the bell of the called subscriber at the distant office begins to ring automatically as soon as the trunk line plug is inserted in the jack of his line without the "B" operator being required to operate a ringing key.

Toll Boards.—The term "toll connection" is applied to connections between subscribers so far removed telephonically from each other that a special toll charge is made for the connection. On account of the fact that the toll lines between one place and another have to be grouped together for efficient operation and that each toll message has to be carefully timed and a ticket record made of the call, connections generally require special switchboard circuits and apparatus at the central office and the service of special operators. In the case of the smaller central offices the toll switchboard is sometimes combined with a portion of the local switchboard. In larger places, to enable adequate toll service to be given, separate large and complicated toll switchboards are ordinarily required. These toll switchboards are usually centralized at one point in the city and are connected by special trunk lines with the local switchboards in the several central offices of the city. In cities of the largest size more than one toll switchboard centre may be required.

Party Lines.—Serving more than one telephone user by means of a single line (party line) enables those having but little use for the telephone to obtain service on a basis which otherwise would be impracticable. The successful operation of the party line depends upon the Carly bridging bell principle already described. The extensive use of party lines to serve farmer's or rural stations, by destroying the isolation of the farmer, has produced a wonderful improvement in his economic and social life by placing him in constant touch with markets and sources of supply, and with the weather bureau, and has provided for his family a means of communication available not only for social purposes, but also ready at all times for summoning help in the event of sickness or danger. On party lines between two stations, and on some equipped with four stations, means have been devised whereby the bell at a given party line station may be rung, the others meanwhile remaining silent.

Private Branch Exchanges.—The important adjuncts to the telephone central office are the private branch exchanges. These consist of switchboards, generally of small size, located in such places as hotels, apartment buildings or large business houses and having connected to
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them all the subscriber's lines in such establishments. Private branch exchanges are also connected with the nearest telephone central office by a sufficient number of trunk lines to handle the traffic arising from and flowing to them. Calls originating within the establishment where the private branch exchange is located, for parties within the same establishment, are completed by the private branch exchange operator without passing through the telephone central office. The introduction of the common battery system greatly facilitated the operation of private branch exchanges and enabled the necessary talking current to be supplied over trunk lines from the central office. Fig. 43 shows a typical private branch exchange of moderate size. Some of the largest private branch exchange switchboards are comparable in size to central office switchboards serving large communities.

Automatic Systems.—Throughout the development of the manually operated switchboard, the tendency was continually toward increasing the use of automatic labor-saving machinery. In the most modern forms of manually operated boards a complete analysis of the switchboard shows that a large proportion of them are performed automatically. The term "automatic" or "machine switching," is, however, applied to systems in which the number of operators required at the central office is reduced to a relatively small number, the switching functions otherwise performed by operators being, to a greater or less extent, performed by electro-mechanical appliances. During recent years there has been extensive development of machine switching systems. The apparatus is highly complex and ingeniously devised.

In what is known as the full automatic system, the subscriber puts the automatic mechanism at the central office in motion and directs it so as to obtain the desired connection by suitably operating a movable numerical dial attached to the base of his substation set. Fig. 44 shows a typical set with the dial. The face of the dial is shown in Fig. 44-A.

Briefly the operation is as follows: Assume connections line 753. The calling subscriber places his finger-tip in the hole of the dial, on his set, over figure 7 and turns the movable part of the dial in the direction of the hands of a clock, until his finger reaches the crescent-shaped stop. He then releases the dial which is automatically moved back, in the opposite direction, by a spring. This motion, by making and breaking a current on the line, seven times, sets in operation in the central office an electro-mechanical device known as a selector, whose function it is to select some idle trunk line in the 700 group. These trunk lines terminate in other selectors of a similar type. By repeating the dialling operation, this time for figure 3, connection is established with the fifty in the 700 group. By dialling once again, this time for figure 3, the line of the calling subscriber is placed in connection with line 753. The selectors are made in a great variety of forms. In one form they consist of a series of drum and subscriber line-sets attached in pairs, Corel another, with selector rods moving vertically in front of these pairs. In another form the terminals are arranged in layers around an arc, contact being established by a cent capable of being raised to the proper then rotated.

In both forms suitable means are pro for automatically ringing the called sube bell and for indicating to the calling party the called line is already in use.

In the semi-automatic system the removes his telephone from the ho mits the desired number by telephine central office operator. The operators manual. Thereafter, however, the operator's automatic machinery at the central o complete the connection, instead of 01 the switching operations manually.

In modern telephone engineering the peculiar factors, surrounding each case a new central office equipment is to be mended, are carefully studied in order to determine whether or not it is necessary to provide a manual connection, the automatic system is, in view of all the cir cumstances, the best. The names of Kell mer, McQuarrie and Strower are among those who have contributed to a switchboard development.

Telephone Lines. Early Lines Telegraph Lines.—The first telephone a copy of the old telegraph line. It was a single iron wire using the great a return circuit. In addition to elec turbances, coming from no one km picked up by these early grounded m frequently causing noises in the too loud as to destroy conversation, ne covered that iron wire was not as a ductor for the telephone current as the telegraph current. The talking therefore, was limited by the impo ing power of the conductor. It was a l that, if the telephone system was to something better than iron wire would required. Various metals and alloys were and it was found that copper best all electrical requirements. But copper wire according to the then state of the art was too weak in mechanical strength. A little conceived the idea that if a wire could be drawn cold through a series the resulting wire's had a tensile strength much greater than am. annealed wire which was the usual wire then known to the trade. He a series of experiments which re production of commercial hard drawn wire having substantially all the electrical characteristics of soft coupled with a tensile strength of that of the soft wire, and fully strength of ordinary iron wire of size.

An experimental line, the first to telephone line in the world, was co 1884 between New York and Boswo among two hard drawn copper wires 01 in diameter. The satisfactory conduction over this line demonstrated mercial feasibility of the new type of, the following year, 1885, another line between New York and Phila equipped with 24 hard drawn copper wires various sizes. Careful experiments on this line established the proper qualitats of the new product and the efficienc of different sizes and vario
ing this development, the use of hard copper wire became the standard for telephone lines, first in the Bell Telephone, and later, the world over, greatly extending the range of transmission. In 1892, New York was placed in telephonic communication with Chicago. The wire employed for this purpose was coated with chrysacron, which was an insulation that could withstand the subzero weather conditions of the Midwest. The wire, which was initially strung on existing iron poles, evolved to being strung on new poles made of concrete and steel. This allowed for a better electrical and mechanical performance, reducing the likelihood of wire breakage due to snow and ice accumulation.

By 1870, the telephone system had expanded significantly, with numerous exchanges and lines being added. The need for a better system to handle the growing number of calls led to the development of the multiple circuit system. This allowed for the simultaneous transmission of multiple conversations. The system was made possible by the use of techniques such as frequency separation and the introduction of the repeater, which allowed for the amplification of the electrical signals over long distances.

The telephone grounded circuit presented a significant challenge. When the system was switched to a grounded circuit, the wires could be directly connected to the ground, which reduced the electrical noise. However, this also led to the ground becoming a significant source of electrical noise, which could interfere with the calls. To overcome this, the principle of the metallic circuit was introduced. The metallic circuit was a circuit that used all metal conductors, which were less susceptible to electrical noise. The principle of the metallic circuit was later refined into the balanced metallic circuit, which further reduced the electrical noise and improved the signal-to-noise ratio. The balanced metallic circuit used a pair of wires, one for each direction of the signal, which helped in canceling out the electrical noise. The result was a more reliable and higher-quality telephone service.

By 1893, the number of telephones in the United States had reached such numbers as to necessitate placing them underground, as they had been strung on poles and roof tops. This was objectionable on account of the corrosion of the iron wires by chimney gases, wires breaking when loaded with snow, and the cost of roof repairing, the unsightliness of the construction and lack of room for more wires. It was, however, the only possible way known at that period. The overhead method was soon outgrown. Some streets in the larger cities had become black with wires. Poles had risen to 50 feet in height, then 60, 70 and 80. Finally, the highest of all pole lines was built along West street, New York City, using 90 foot poles of Norway pine, and carrying 30 crossarms and 300 wires. (Fig. 45). This condition of wire crowding was overcome by the development of cables, later described.

**Telegraph Grounded Circuit. Difficulties.**—When the ground was used for the return circuit, not only was the talking distance limited by the confusing effect of all sorts of disturbing currents from the atmosphere and from neighboring telegraph wires, but also, when a second telephone wire was strung alongside of the first, even though perfectly insulated from it, conversation carried on over one of these wires could be heard plainly on the other.

**The Balanced Metallic Circuit. Open Wire Lines.**—In 1883, it was discovered that the bad effects of these disturbing currents could be greatly lessened by severing the earth connection from the ends of each wire, and substituting a second wire for the return circuit through the earth. The new arrangement was known as the “metallic circuit.” For the reason that the “metallic circuit” principle involved rebuilding practically the entire plant, telephone engineers sought less costly methods of reducing the electrical disturbances.

Between 1885 and 1892, large numbers of so-called anti-induction devices were proposed and investigated. None of these proved sufficiently successful to warrant adoption. Those that killed induction killed transmission as well. A system using a common return wire for a number of telephone circuits was used to a considerable extent. It reduced the disturbances due to ground potentials but was not effective against induced currents. The reconstruction of the telephone plant on the metallic circuits basis was carried out largely between 1890 and 1900.

To aid further in rendering metallic circuits free from induction from power circuits and from crosstalk, the wires were transposed (i.e., interchanged in position on the crossarm) at periodic intervals of space. The first transposition scheme was worked out in 1886.
Fig. 46 shows a typical transposition diagram for the 10 wires carried on one crossarm of a line. On this diagram the vertical lines represent poles 1,300 feet apart, that is, about every 10th pole. The interchange in position of the wires is indicated by the crossing of the horizontal lines which represent the wires. At the points indicated by small circles, special types of transpositions are placed to admit of phantom circuit working (described below). To ensure quiet circuits, the apparatus used with metallic circuits has to be carefully balanced when arranged for talking. Wherever a ground connection is used, as in some forms of signalling, it has to be placed at a neutral point in the telephone circuit.

Balance in the line circuits is attained by uniformity in the wire used and by suitable arrangements in its installation and mainten ance. Any slight imperfection in the balance of the line conductors in phantomed circuits manifests itself by crosstalk between the phantom and its constituent circuits. While the metallic circuit, transposed according to the methods first devised by the Bell engineers, eliminated the outside disturbances that existed at the time, this was not the state of affairs for long. Powerful electric light and power circuits began to spring up and methods which had formerly been successful in protecting the telephone from disturbing currents were not effective against these new high powers. Years and years of work have been devoted to safeguarding the telephone circuit from these disturbances, and each new success which the telephone engineer has accomplished in this direction has been followed by a further advance in high potential and high current on the part of the power circuits. It has been said with truth that if these high power circuits had been discovered and in use before the telephone was invented, the results obtained from the first telephone lines would have been so utterly impracticable that it is hard to think of any one being rash enough to regard the telephone as having any commercial value.

Phantom Circuits.—It is possible to make a third circuit out of two metallic circuits by connecting them together, with suitable apparatus, in a peculiar way. (Fig. 47.) The third circuit is termed a "phantom" circuit. Conversations can go on over a phantom circuit without disturbing, or being disturbed by, simultaneous conversations over the two metallic circuits from which the phantom circuit is formed. The operation of the phantom circuit depends upon the principle that if two currents of equal strength, and similar in all respects to form, are transmitted simultaneously over the two wires of a circuit, they produce no sound in the telephones associated with that circuit. Fig. 47 shows how the phantom current is equally means of connections to the middle repeating coil windings, so that it m.

![Diagram showing use of Phantom Raps](image)

### Fig. 46. Typical Transposition Diagram for Transposition Sections over 21,120 feet in length. Phantoms on pins 3 and 7-10.

Aerial and Underground Cable Construction.—In 1881, the first underground cables were laid along road track at Attleboro, Mass. The insulation known at that time, rubber or gutta percha, was found to be unsuitable for telephone work. Conversation conducted through cables of this kind that insulation was muffled, overheard from one circuit to another, and troublesome. In 1882 several cables were laid at Boston, Mass., the longest of which was about 1,500 feet. It was found that cables were cut in connection with the suburbs, the voice was indistinct that, unless the difficulty was removed, the connection with points out of city would have been almost, if not entirely, useless to those whose wires were underground. Type after type of cable was installed and be withdrawn in a few years and replaced by something better.

The use of rubber insulated cables followed by the development of a cable in which the individual wires were covered with insulation and drawn into a pipe were then filled with oil. This oil-filled carrier the telephone circuit through.
Fig. 42-B — Front View of Single Position of Modern Common-Battery "A" Switchboard
Fine Wire Cable.—The extraordinary increase in the number of the telephone wires, and the difficulty in many places of obtaining additional space underground led to the development of the so-called fine wire cable, a modification of cable employing wires No. 22, B. & S. G. in size (0.0233 inches in diameter). The progress made in this development is shown in the following table which gives, for cables of No. 22 gauge wires, about 2½ inches in outside diameter, the date when a cable of the given number of pairs was made available for commercial use.

<table>
<thead>
<tr>
<th>Date</th>
<th>Number of pairs of No. 22 gauge wires</th>
</tr>
</thead>
<tbody>
<tr>
<td>1900</td>
<td>300 and 400 pairs of wires</td>
</tr>
<tr>
<td>1903</td>
<td>600 pairs of wires</td>
</tr>
<tr>
<td>1912</td>
<td>900 pairs of wires</td>
</tr>
</tbody>
</table>

During 1914, there was developed a type of underground cable carrying 1,400 pairs (2,400 wires) No. 24 B. & S. G. in size (0.0201 inches in diameter). Fig. 48 shows a cross-section (reduced in size) of this cable. The improvement which it represents may be understood when it is known that to carry the same number of open wires on poles would require large huge pole lines of the size shown in Fig. 45. The economics accomplished by these improvements are not limited to the cables themselves, but extend to the underground duct systems whose capacity is multiplied enormously by the increase in the number of wires which each cable may carry.

It was early found that lead alone did not possess the requisite corrosion-resisting and strength properties for underground cable sheaths. Aerial cables, furthermore, are subject to peculiar conditions causing vibration in the cable, and a tendency to crystallization of the sheath if pure lead is employed. For a long period, cable sheaths having the proper qualities were made of lead alloyed with about 3 per cent of tin. Considerable increases in the cost of tin led to experimental investigations of a wide range of other alloys. This resulted in finding, in 1912, a cheaper and at least equally efficient alloy in which the lead was alloyed with a very small amount of antimony.

Early Intercity Cables.—In the earliest interurban cables every effort of the engineers was bent toward improving transmission efficiency by using wires of large size so arranged in rolling as to secure a soft core giving the lowest practicable mutual electrostatic capacity between the wires of a pair. Wires as large as 0.958 inches in diameter were used and cables of this character as long as 25 miles were placed. In European practice, the use of wires even larger than this continued for many years. In the United States, the development was in the direction of using smaller wires provided with means for improving their transmission efficiency so that it not only equaled, but considerably exceeded that obtainable with the larger and more expensive wires. By 1902, the art had so advanced, by the use of Pupin loading coils (described below) and other improvements, that a loaded cable for suburban toll service was successfully installed between New York and Newark. By 1905, a loaded cable 20 miles long had been extended from New York in the direction of Philadelphia, and by 1906, a cable 90 miles long was successfully operated.
TELEPHONE

between these two cities, but in the then state of the art, that cable could not be used beyond Philadelphia or New York.

**Boston-Washington Underground Cable.** During the year 1913 such advances were made in the art of building and balancing underground circuits, and such improvements in the use of repeaters (described below) that it became possible to talk satisfactorily by underground wires from Boston to Washington, a distance of about 480 miles, employing a cable (Fig. 49) so designed that the phantom principal could be employed in it. At the present time, there are underground cables along this whole route, furnishing service of the highest reliability between many important cities, the number of cables varying from two to four, depending on the density of the telephone traffic.

Loading is used on all the circuits in these cables, and repeaters are applied to a large proportion of the circuits over 60 miles in length. The Boston-Washington telephone cable is several times longer than any other in the world. These developments tended to increase greatly the long-distance traffic and to accomplish enormous savings in the amounts of copper which otherwise would have been required to establish communication between remote points.

**Telephone Transmission Theory.** In telephony, as already described, mechanical vibrations of the transmitter diaphragm set up electrical oscillations. These are transmitted over the wire and set up corresponding mechanical vibrations of the receiver diaphragm. The following section deals with the electrical characteristics of the telephone circuit and the transmission of telephone currents over it.

To develop the principles of telephone transmission, it is necessary to know the character of the speech waves. For ordinary practical work, satisfactory results are obtained on the basis that each wave, broadly the overtone of the vowel, consists of a carrier wave at some frequency characterizing the vowel, from 300 to 400 cycles per second, on which are superimposed, §

**Fig. 49.—Diagrammatic cross-section of Boston-Washington Underground Cable. Outside diameter, 2 9/16 inches.**

### Differential Equation

The differential equation determining the transmission of current over the line with these constants is as follows, *a* being the constant for the line, *b* for the distance measured along the line and *c* for the time:

\[
\frac{d^2i}{dx^2} = \left( \frac{1}{LC} \frac{di}{dx} + [RC + LG] \frac{i}{dt} + RG \right)
\]

For a current of a given frequency 1 cycles per second, there may be deduced from the above equation, the following expression for the impedance at any point on the line, when the current at the send end is 1 amp.

\[
i = \frac{-ax}{1 + \omega^2 \sin(p - \beta x)}
\]

In this expression are used two constants, *a* and *b*, known respectively as the propagation constant, and the wave length constant. The expressions for these constants are:

\[
a = \sqrt{\frac{1}{V \sqrt{(L^2 + R)(L^2 + G)}}} + \frac{1}{RG} - \frac{1}{L}
\]

\[
b = \sqrt{\frac{1}{V \sqrt{(L^2 + R)(L^2 + G)}}} - \frac{1}{RG} + \frac{1}{L}
\]

The first of these constants determines the rate at which the current diminishes in value as it passes along the line. The second determines the velocity at which electrical energy is propagated along the line. Another important constant of a line is its so-called "charac
teristic impedance," which is the ratio of the current to the voltage applied to it at the current end.

In terms of the above noted constants, the expression for it is

\[Z = \sqrt{\frac{R + j \omega L}{V_0 + j \omega p}}
\]

Where a line is not electrically long, assumed to be terminated with an impedance differing from the characteristic impedance of the line, the above formula as given for the current at any point on the line will not be satisfied. The equations, which are almost identical, however, may be used in this case.
ne must be modified to take account of reflection effects which take place due to changes in impedance. Such reflection be reduced, in practical cases, by a transformer of proper ratio between or between a line and terminal apparatus in a different impedance. An analysis of formulae will show that not only is the volume of energy received at transmitted, but the characteristic of the speech wave. In addition to this distortion, there is further due to transient effects of different rates, the higher frequencies undergoing the attenuation. Therefore, not all of the transmission is transmitted, but the characteristic of the speech wave is reduced. Lines.—"Loading" is a practice for increasing the efficiency of telephone circuits by increasing the mutual inductance of the circuit, but the practical possibility of doing this has been realized but no one to point out any practical increasing the distributed mutual-telephone circuit without bringing into operation the other which. Vaschy, Heaviside and others suggested or unsuccessful tested the mutual inductance of coils on a means of increasing their efficiency. No practical results their work and no actual has made in the matter of using a small number of such coils is contained in a single case as shown in Fig. 52. Fig. 53 shows a typical form of loading coil of the kind applied to open wire lines.

The function of these coils is to reduce attenuation losses in the line. They bring in no new supply of new energy, but make the line a better conductor for telephone currents. On open wire lines they are placed at intervals of about eight miles. On cable circuits they are placed at intervals of from one to two miles depending upon the size of the cable conductor to be loaded and the character of the loading. The use of these coils approximately doubles the range of transmission practicable with open wires of a given size and increases the range of cable transmission three to four-fold. In other words, by means of loading it became possible to talk over cable circuits three to four times as far as formerly, with equally good transmission results.

The fundamental principles of loading, as disclosed in the patents of Pupin, were in mathematical form. The development work required to embody the theory of loading in practical loading coils has been a task, constituting the work of years of a large group of highly trained scientific men on the technical staff of the Bell System. The application of loading has comparatively recent been extended to power circuits so that it is now possible to load not only the physical or side circuits composing a phantom circuit, but also the phantom circuit itself. Phantom loading is applicable to properly constructed cables (called duplex or "quadded" cables) as well as to open wire lines.

**Telephone Repeaters.**—A highly important method of improving the transmission efficiency of telephone circuits is the insertion into them of devices known as "telephone repeaters," which increase the amplitudes, or strength, of the telephone currents that pass through them, without changing the effective form of the waves. The energy added by the repeaters is drawn from a battery associated with the repeater itself.

The telephone repeater may be considered as consisting of two parts: (a) the repeater element, that is, the amplifying device itself; and (b) the circuits and associated apparatus for connecting the repeater element, or elements, into the line.

The first form of repeater element to come into commercial use was the so-called "mechan-
ical" type consisting, in principle, of a telephone receiver acting directly into a telephone transmitter. A simplified diagram of this repeater is shown in Fig. 54. Currents received from the line flow through the winding of a receiver magnet acting upon a diaphragm carrying one electrode of a transmitter button, thus causing to be put out currents of approximately the same form as the incoming waves, but of greater amplitude.

The preferred form of telephone repeater element is now the "vacuum tube" type. This was developed by the Bell engineers from a device known as the "audion," invented by DeForest for other uses. The structure of this type of element is shown in Figs. 55 and 56. It consists of a highly evacuated glass bulb in which are placed three parts, known as filament, grid and plate. Referring to Fig. 56, the filament is composed of materials which, when heated by current from battery $A$, give off electrons actively. Under the action of battery $B$, these electrons pass from the filament to the flat electrode, known as the "plate," thus constituting an electric current. This is termed from its grid-like structure generally at a potential filament by battery $C$. The grid sets up variations in potential between the grid and filament, and thus produced causes corresponding changes in the current between the filament and plate.

![Fig. 54—Simplified Diagram of Mechanical Type Repeater Element.](image)

![Fig. 56—Diagram of Vacuum Tube Repeater. (The grid and plate at the left hand side of the filament are omitted for the sake of clearness).](image)

The circuits for connecting the repeaters into the line to give transmission in two directions are of various types, the two most common forms being shown in Figs. 57 and 58. The first includes a single repeater which amplifies the energy for transmission in either direction. The second includes two repeater elements for transmission in two directions. An important feature of these circuits is the balanced condition essential.

The circuit diagrams show certain apparatus such as the "balance," combination of coils and condensers, the actual line for balancing purposes, a "potentiometer," a device for adjusting; and the "filter," which serves as a certain undesirable current element.

Referring to Fig. 57, it will be seen if the lines in both directions are not balanced, similar impedances are produced, leaving the repeater cause no current to be set up in circuit of the repeater element. The circuits are sufficiently distance to be imperfect, and current, as the repeater element will cause currents to be amplified, thus setting up a circuit in which current will flow. If the circuit is not so great to produce steam, there may still be considerable distortion by it.

In the case of the second circuit, similar conditions hold, except that...
each line is balanced against an artificial line as indicated. If the unbalances at these points are not kept small, sustained oscillations may be set up as in the case of the other circuit, but in this case the circulating currents must flow through the two unbalances in series. If either balance is very good, the other unbalance may be large without unfavorable results.

The balances noted above must be obtained for all of the frequencies important in telephone transmission. The impedance of a circuit, measured at any point, is affected by every part of the circuit, the amount of the effect caused by any part being dependent on the amount of attenuation between the part being considered and the point at which the impedance is being measured. It is, therefore, evident that these balance conditions are affected by every part of a circuit on which the repeaters are used, so that every part of a circuit containing repeaters must be carefully designed with respect to this characteristic. For high grade repeater elements, the improvement obtainable under any particular circumstances is dependent, almost wholly, on line conditions.

Transcontinental Circuits.—The best known circuits on which repeaters are used are those which place the cities along the Atlantic seaboard in telephonic communication with the cities along the Pacific Coast. Without loading and repeaters it would be impossible to talk 3,000 miles with the same grade of transmission that is actually obtained over these circuits 4,000 miles in length.

Further Advances.—By the joint operation of loading and repeaters, coupled with other ground cable, are generally subject to disturbances from lightning, and to the possibility of accidental contact with ordinary electric light and power distribution wires. When these conditions exist, protectors are successfully used on the telephone lines to minimize the hazard to persons and property. It is not practicable to use protectors which will handle the large amounts of energy that would be imposed on telephone lines by high voltage transmission circuits coming in contact with them. Protection from such circuits is obtained by keeping them separated from the telephone circuits wherever practicable and, where adequate separation is not practicable, by building the lines of high strength so as to prevent contact.

Multiplex Telephony.—The only type of multiplex telephone apparatus that has been developed into form suitable for commercial use is known as the carrier current multiplex system with which it has been found commercially practicable to transmit five telephone conversations simultaneously over the same pair of wires. This requires sending over the line five different currents at the same time and providing means, at the end of the line, whereby these currents may be completely separated from each
other so that each current, coming from one particular telephone at one end, may go to a particular telephone at the other end, although on the line the five currents have all been mixed together. This is done by combining each ordinary telephone current with a current of definite higher frequency, termed a "carrier current." The frequency of each of the carrier currents is different from that of the other connections being completed within board. Large cities have a number of boards, connected together by trunk lines connecting each switchboard with other important switchboard in the reach of the smaller central offices, in sections of a large city, from central particularly those in a distant portion.

![Simplified Diagram of Circuit with Two Repeater Elements](image)

carrier currents used on the same pair of wires and is adjusted to the separating devices at the distant end of the line. The arrangement is applicable on lines of such length that the installation of the necessary apparatus gives a saving in cost compared with erecting new circuits.

Telephone Systems.—The Bell System consists of nearly 11,000,000 telephone stations scattered all over the United States. Each station is enabled to connect with the nearest central office, of which there are upwards of 5,700, by a pair of wires called the subscriber's line, or "exchange circuit." Due to party lines and private branch exchanges, about 3,700,000 exchange circuits serve to connect all the stations with the central offices. In places of moderate size there is usually one switchboard, to which all of the subscribers' lines are brought, local

it is sometimes necessary to make use of or more trunk lines, connected together by intermediate operators for the purpose of relaying such a call. In the business part of the largest cities where the telephonic is at the highest, more than one switch sometimes placed in a central office building.

In New York City, the largest exchange in the world, there are upwards of telephone stations, connected by more than 400,000 lines with 87 central offices which are interconnected by more than 50,000 trunk handling local calls only.

Connections between exchanges in cities are completed over toll and local lines. More than 3,000,000 miles of use for this purpose. Special trunks, usually employed for connecting central with toll and long distance.

---

**Statistics: Number of Telephone Stations in United States.**

<table>
<thead>
<tr>
<th>YEAR (1 Jan.)</th>
<th>Bell system</th>
<th>Independent</th>
<th>Total Bell and independent</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Owned stations</td>
<td>Connected stations</td>
<td>Total</td>
<td></td>
</tr>
<tr>
<td>1910</td>
<td>30,572</td>
<td></td>
<td>30,572</td>
<td>30,572</td>
</tr>
<tr>
<td>1915</td>
<td>31,715</td>
<td></td>
<td>31,715</td>
<td>31,715</td>
</tr>
<tr>
<td>1920</td>
<td>270,381</td>
<td></td>
<td>270,381</td>
<td>270,381</td>
</tr>
<tr>
<td>1925</td>
<td>2,220,748</td>
<td></td>
<td>2,220,748</td>
<td>2,220,748</td>
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<tr>
<td>1930</td>
<td>1,417,536</td>
<td></td>
<td>1,417,536</td>
<td>1,417,536</td>
</tr>
<tr>
<td>1935</td>
<td>1,558,495</td>
<td></td>
<td>1,558,495</td>
<td>1,558,495</td>
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<tr>
<td>1940</td>
<td>1,563,093</td>
<td></td>
<td>1,563,093</td>
<td>1,563,093</td>
</tr>
<tr>
<td>1945</td>
<td>1,568,451</td>
<td></td>
<td>1,568,451</td>
<td>1,568,451</td>
</tr>
</tbody>
</table>
3,400 trunk lines are used for this purr
ny New York City alone.

There are, in the Bell System, about 200,000
years. It is impossible to describe, in an
cent length, many inventions in the oper-
ine of the telephone systems, as traffic and commercial features.

**PHONE WIRE MILEAGE OF THE WORLD**
(1 Jan. 1914)*

<table>
<thead>
<tr>
<th>Country</th>
<th>Miles of wire</th>
<th>Per cent of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>States</td>
<td>22,137,000</td>
<td>59.3</td>
</tr>
<tr>
<td>Europe</td>
<td>3,149,000</td>
<td>8.1</td>
</tr>
<tr>
<td>Total</td>
<td>25,286,000</td>
<td>67.4</td>
</tr>
<tr>
<td>Total, over 1 r countries</td>
<td>2,251,300</td>
<td>6.0</td>
</tr>
<tr>
<td>All together</td>
<td>27,537,300</td>
<td>100.0</td>
</tr>
</tbody>
</table>

**ER OF TELEPHONE STATIONS IN THE WORLD**
(1 Jan. 1914)*

<table>
<thead>
<tr>
<th>Entry</th>
<th>Number of stations</th>
<th>Per cent of total population</th>
<th>Population per square mile</th>
</tr>
</thead>
<tbody>
<tr>
<td>States</td>
<td>14,632</td>
<td>64.09</td>
<td>9.7</td>
</tr>
<tr>
<td>Europe</td>
<td>499,800</td>
<td>3.36</td>
<td>6.5</td>
</tr>
<tr>
<td>America</td>
<td>7,900</td>
<td>0.05</td>
<td>0.1</td>
</tr>
<tr>
<td>Total</td>
<td>518,332</td>
<td>6.04</td>
<td>4.1</td>
</tr>
<tr>
<td>Total, over 1 North American places</td>
<td>27,000</td>
<td>0.2</td>
<td>0.4</td>
</tr>
<tr>
<td>Total, over 1 jco</td>
<td>6,160</td>
<td>0.11</td>
<td>0.7</td>
</tr>
<tr>
<td>Total, over 1 Total Europe</td>
<td>4,400</td>
<td>0.3</td>
<td>0.4</td>
</tr>
<tr>
<td>Total, over 1 India</td>
<td>6,600</td>
<td>0.04</td>
<td>0.1</td>
</tr>
<tr>
<td>America</td>
<td>166,300</td>
<td>1.02</td>
<td>0.5</td>
</tr>
<tr>
<td>Total</td>
<td>4,012,700</td>
<td>26.05</td>
<td>0.8</td>
</tr>
<tr>
<td>Total, over 1 North American places</td>
<td>306,100</td>
<td>2.05</td>
<td>0.04</td>
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<tr>
<td>Total, over 1 Total Europe</td>
<td>65,100</td>
<td>0.44</td>
<td>0.12</td>
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<tr>
<td>Total, over 1 India</td>
<td>217,400</td>
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<td>0.4</td>
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<tr>
<td>Total</td>
<td>14,888,600</td>
<td>100.0</td>
<td>9.9</td>
</tr>
</tbody>
</table>

*Complete European statistics of a later date than above available.

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**TELEPHONE SYSTEMS, COST OF INSTALLING AND MAINTAINING.** See TELEPHONE SYSTEMS, INDEPENDENT.

**TELEPHONE SYSTEMS, Independent.** Under this designation are placed all those telephones not owned by Bell system companies, such as certain telephones used for military purposes, some of the telephones in those cities where there are two or more exchanges existing and operating side by side, such interior telephones as are used solely for intercommunication in buildings, hotels, factories, etc., and some of the farm or rural telephones.

The original Bell patents expired in 1893 and for 17 years prior to the expiration the Bell patents were held to the first inventor of the telephone were upheld in the United States and all telephones in commercial use were supplied under license by the predecessors of the American Telephone and Telegraph Company. Upon the expiration of the original Bell patents, numerous manufacturers began to supply telephone instruments and considerable numbers of these came into use especially in the rural districts.

*Transactions of American Institute of Electrical Engineers.*
For many years the independent development of the telephone business has been in progress largely in the rural districts where local and rural independent companies are established. A large proportion of these have connection contracts with the Bell system. These lines are found in every part of the country, uniting homes, factories and camps by means of party lines, which allow conversation between the different stations of the line as well as from any station to a central exchange.

Up to the present time the independent telephone movement has placed more than 800,000 American farmers, timbermen and miners in touch with their markets, their own communities and towns and cities near them. The movement has been especially active in the Middle and Western States. These telephones are not only for general purposes of communication, and in numerous ways for securing information regarding market quotations, but also in gaining information of financial value and advantage. The independent telephone business, however, is not limited to the country districts, but has established itself in a number of cases in towns and cities.

In many cases, where two systems have come into existence, side by side, arrangements have been made to consolidate the systems by one interest disposing of its plant to the other. Such consolidations have very generally met with the approval of regulatory bodies and in this way many telephone users have had their range of communication greatly extended.

The growth of the independent systems increased over 250 per cent in the decade beginning about 1902 and ending in 1912. In the year first named there were reported in operation 9,092 independent systems and lines with 1,512,527 miles of wire. The number of telephones operated on these systems was 1,053,866 and the number of messages or conversations per annum was estimated at 1,996,024,493. In the year 1912 the independent systems had increased to 32,157 with 5,115,140 miles of wire and operations of 4,642,345 telephone instruments. The estimated number of messages or conversations over these independent systems in the latter year was 4,602,431,409. Of the total number of stations in the Bell system, in 1918 (10,992,325), 3,700,568 were owned by local cooperative and rural independent companies or associations having subconnection or connection contracts with the Bell system. There are in the United States 9,336 independent companies whose telephone systems connect with the Bell system, and about 1,600 independent companies whose telephone systems do not connect with the Bell system. There are also a large number of rural lines and systems which connect with the telephone systems of these companies, over 20,000 of which are connected with the Bell system. There are about 1,000,000 stations owned by independent companies not connected with the Bell system.

The exigencies of war service emphasized the great adaptability of the telephone to many situations and there was an increased call for telephones systems for reporting enemy operations, directing the movements of troops, munitions and supplies, controlling artillery fire and in numerous other ways increasing the effectiveness of the armed forces.

The scientific investigation of electric waves has resulted in a clear understanding of the generation, propagation and reception of these waves and in the development of wireless telephony. The requirements of successful radio-telephony began with a system of undamped waves of very high frequency so that the wave trains when received were not within the range of audibility. Wireless telephony owes much to the work of the engineers at the American Telephone and Telegraph Co., who, in the latter part of 1915, succeeded in telephoning by wireless from Washington, D.C., to Paris, and from Washington to Hawaii a distance of 4,900 miles. The expense of installations for long-distance wireless telephony may limit competitive systems, but it is possible to look for the widespread employment of the short-distance wireless telephones.

Arms in the field employ portable wireless sets for insuring communication between scattered commands. Some sets for use in armored country are arranged to be carried on wagons, one for the generator and another for the wireless apparatus. The European War gave especial impetus to the development of wireless telephony, especially as applied to destroyers and aeroplanes due consideration being given to the extremely limited space available and the limited weight that could be carried. On board airships of the Zeppelin type it is possible to employ a powerful apparatus, hence a greater range can be covered.

A typical airship installation consists of a transformer, quenched spark gap, capacitors, inductance, aerial wire lowerer, down winch, anemometer, rapid-change switch for current wave-lengths and an alternating-current generator driven off one of the engine gensets and an airship. Such a set weighs about 55 pounds without the alternator and has a range of 60 and 120 miles. The aerial wire is 200 feet long when fully paid out.

TELEPHONE TRANSMITTERS.

TELEPHONE.

TELEPHONES, Electrical. See PHONE.

TELEPHONES, Farm. See Telephones, Independent.

TELEPHONY, Wireless. Prior to the invention of the telephone, signals were transmitted by means of a lens upon a cave mirror carried on the exact focus of the lens. This device, Fig. 1, a beam of light transmitted by means of a lens upon a cave mirror, was employed by Bell, the inventor of the telephone, in which light rays were used to transmit sound. This device, Fig. 1, a beam of light transmitted by means of a lens upon a cave mirror, was employed by Bell, the inventor of the telephone, in which light rays were used to transmit sound.

Fig. 1—Bell's Photophone.
lected from the mirror are directed upon
ning apparatus by a double convex mirror
nally positioned. In the receiving appara-
nall selenium cell is placed in the focus
ecular reflecting. This cell is made
an electric circuit consisting of a tele-
receiver \( t \) and an ordinary dry cell \( b \).
\( b \) possesses the property of varying its
stance with the variations of light
h it is exposed. Hence when speech is
at the mouthpiece the diaphragm con-
sonance with the sound waves of
r. These vibrations cause variations in
rays reflected from the small mirror,
variations are reproduced at the selenium
his in turn causes variations in the re-
and current of the telephone circuit and
ch spoken at the mouthpiece is repro-
the telephone receiver.
rate of air vibrations or oscillations due
anges from about 20 to 20,000 per
wireless telegraphy wave or
on is equal to the speed of electricity,
miles per second, divided by the number
ations per second, it is evident that the
of electrical oscillations of 20 to 20,000
ymphs is comparatively great. Hence, to
tral without wires electrical osc-
set up primarily by the voice by means
telephone transmitter, aerial wires about
; in length would be necessary, which is
ible.
reasons that will become obvious it may
miss to refer here to the Van Ryssel-
system of Simultaneous Telegraphy and
y which for years has been in serv-
 large scale in this country. This sys-
briefly described in the article on Tele-

Any action of the telegraph sig-
the telephone receiver is prevented by
duction coils in the circuit which makes
and fall of the telegraph currents so
that the diaphragm of the telephone re-
merely deflected and does not produce
iable sound. Upon this gradual rise and
the telegraph current is superposed the
ions of the speech waves set up by
phone transmitter on the same wire,
unciation of the circuit. In electrical dia-
struments. Quoting from Mauer,
amic Telegraphy, p. 347, "the the-
operation of simultaneous telegraphy
phony may be briefly outlined as fol-
Assuming, for example only, the
of the telegraph current to be 2,000
 of the telephone current to be 1. If,
e diaphragm of the telephone receiver is
or in process of gradual attraction by
ph current of positive direction, a tele-
current of the same direction be trans-
 the total current will be suddenly in-
to 2,001 and the diaphragm will be
minute impulse toward its mag-
nould then a negative telephone current
the telegraph current remaining as be-
current on the line will be suddenly
1,999 and the diaphragm by its own
cedes rapidly from its magnet. In the
operation of these systems many hun-
t Pulsatory currents might be sent dur-
time taken to transmit one telegraphic
ent and thus, while the diaphragm is be-
bly attracted to or is gradually receding
from its magnet owing to variations in the tele-
graph current, at the same time it may be mak-
hundreds of intermediate forward and
ward movements of less amplitude, due
the variations of the line currents caused by
the telephone transmitter in transmitting speech
waves." In present day language the foregoing
would be termed a modulation of the telegraph
current in accordance with the variations of
current due to voice waves.
It was recognized by the early workers in
wireless telegraphy and telephony that if it
should be found practicable to modify or modu-
late the high frequency ether waves utilized in
wireless telegraph operation, it would be pos-
sible to transmit speech without wires to a dis-
tance approximating that of wireless telegraphy.
A difficulty, however, in avail of high fre-
quency electromagnetic waves for this purpose
has been that as ordinarily obtained from the
discharges of a condenser at the spark gap in
wireless telegraphy such waves are inten-
tent and their amplitude is not uniform, but is
quickly damped, as noted in the article Wire-
less Telegraphy. Thus, in case of an alter-
ating current generator developing a current
of, say, 60 cycles, or 120 alternations per sec-
ond, there will be 120 sparks per second at the
gap if at each alternation the oscillation
is charged to sparking potential, which
is not always the case. Assume that each dis-
charge of the oscillation circuit gives rise to
oscillations of a frequency of one million per
second in that circuit, with a consequent wave
length of 300 meters. The exact number of os-
cillations and wave length depends on the in-
ductance and capacity of the oscillation circuit.
(To conform to the word inductance the capac-
ity of a circuit is now frequently termed capac-
 itance). As the capacitance of the aerial
is usually supplied by the aerial wires and is not
readily variable, the frequency rate is varied
by placing an adjustable inductance in the aerial
ircuit in the shape of a spiral coil of wire more
or less of which may be inserted in or removed
from the circuit. The capacity of the aerial is
sometimes reduced, for short wave signaling,
by placing a condenser (capacity) in the aerial
circuit. In electrical diagrams a variable or adjus-
table condenser or inductance is conventionally
indicated by an arrow through the apparatus.
In the case of point if the oscillations were
maintained throughout the interval between dis-
charges there would be 8,334 oscillations per
spark, that is, the quotient of 120 divided by 120.
Since, however, the oscillations in such a
ircuit die out very rapidly, due to the damped
ing effects mentioned in the article Wireless
 Telegraphy, there are only two or three strong
oscillations for each discharge in highly damped
circuits and 10, 20 or 30 strong oscillations in
less strongly damped circuits. Hence oscillations
are only maintained during a brief interval
between spark discharges, leaving approxi-
mately the one hundred and twentieth of a
second between such discharges during which
there are no oscillations in the oscillation circuit
and at that time no waves are radiated from
the aerial. In wireless telegraphy these inter-
mittent or group oscillations after reception by
the detector are observable in the telephone
receiver as a continuous tone or buzz which is
broken into dots and dashes of the Morse alpha-
bet by a telegraph key. If the attempt were made to superpose vibrations corresponding to voice waves upon these intermittent or broken oscillations, it is evident that portions of the voice waves set up by the transmitter would be lost.

Kennedy has mathematically demonstrated that speech might be transmitted telephonically with harmonics, or overtones, not exceeding 2,000 per second, but Poulsen has found by experiment that for satisfactory speech a frequency of at least 20,000 per second must be employed, otherwise disagreeable noises will be heard in the telephone receiver. Therefore, continuous or sustained oscillations of a fairly high frequency and uniform amplitude are essential upon which to superpose the voice frequencies for successful wireless telephony. To this end fairly successful efforts have been made by different inventors to produce a machine generator, or alternator, capable of driving an alternating current of very high frequency notably by Fessenden, Goldsmith and Alexander. Owing to the mechanical difficulties of construction of such machines it is perhaps a question whether they will ever be successful in general use. Nevertheless such machines have given and are giving good service in a number of instances. An idea of the difficulties of construction of high frequency alternators may be gained from a recent paper by Alexander, Proceedings American Institute Electrical Engineers (October 1919).

Another method of obtaining sustained electrical oscillations is known as the singing arc, due to Duddell, who discovered that when an arc lamp is in shunt with a capacity and an inductance of given proportions, a musical tone is set up in the arc. Ultimately Duddell obtained frequencies of 40,000 per second from this source. An explanation of this phenomenon is that the arc circuit is divided into two parts, one current flows from the arc circuit into the condenser or capacity circuit which decreases the current flowing in the arc. This increases the electromotive force between the terminals of the arc, causing still more current to flow in the condenser circuit raising its electromotive force above the normal voltage of the arc. Consequently the condenser begins to discharge back into the arc, increasing the current therein and reducing the electromotive force between its terminals, and the reverse process is set up, and in this way continuous oscillations are maintained in the arc and shunt circuits.

When sustained oscillations are comparatively uniform in amplitude and their frequency is above audibility these oscillations are not heard by the telephone receiver. But, while the telephone receiver or at least the human ear will not respond to such high frequencies, if the amplitude or contour of the oscillation waves be modified by speaking into a microphone connected with the oscillation circuit, or in the aerial circuit of a wireless system, a telephone receiver will under proper conditions reproduce the speech spoken at the transmitter, virtually as speech is reproduced modulating the amplitude of a beam or a telegraph current in the case previously cited. The terms "high frequency" and "audible or low frequency oscillations" are now commonly used to the inaudible high frequency oscillations and audible or low frequency oscillations, respectively, in wireless telephony.

The discovery of the oscillating arc was the way for the use of sustained oscillations at high frequency and by means of modulations of Duddell's device much progress made in wireless telegraphy and telephony. Such devices are now sometimes used radio transmitters or arc converters.

An important improvement in the oscillating arc is that due to Poulsen. Poulsen arrangement the positive electrode is the arc is a water-cooled copper cylinder and the negative electrode is carbon. The arc is in a strong magnetic field which tends to blow the arc, after the Elihu Thomsom. The direct current supply for the arc current generator supplying current to the arc changes from alternating currents of frequency of 60,000 per second. The power efficiency of the arc converter is 20 per cent.

A very important source of sustained frequency oscillations in wireless telegraphy and telephony is the electrode in a high vacuum tube to which extended reference will be made herein.

A great advantage of sustained oscillations in wireless telephony and telegraphy is that the property of resonance is more fully utilized than when intermittent oscillations are employed. Be noted that in wireless telegraphy and telephony reliable operation the receiving apparatus is practically the same. In wireless telegraphy the full effect of the reflected waves is utilized. In wireless telephony only a small portion of the emitted wave energy is available, that is caused by the action of the telephone receiver, estimated to be about 5 per cent. of the total energy radiated. This, however, is amplified by the high voltage detector and is not now of much importance. See TELEGRAPH, WIRELESS.

De Forest Wireless Telephone.—In 1900 De Forest outlined an arrangement of the De Forest wireless telephone system employed in 1909; possibly prior thereto. A singing arc is employed as the source of sustained frequency oscillations. C is a variable condenser. L is a transformer or tuning coil, the steel wire of which is in series with the wire A, and a microphone transmitter amplifies an arc with carbon. Carbon is the electrode and the carbon is the stationary contact, or inductances, in the circuit, used to shut out the high frequency oscillations of the arc from the generator.
s up in the circuit, $C$, $p$ sustained are radiated as electric waves aerial wire $A$. Speech spoken into $M$ modulates the amplitude of these actially in a manner equivalent to $1$ of the voice currents in the Varn- the simultaneous system of telegraphy shony upon the telegraph currents. There is, of course, the difference of latter case it is the slow telegraph of current that are modulated by the in the telephone receiver. The incoming high frequency, or radio sustained oscillations, as stated, do not perceptibly affect the telephone receiver owing to their regularity, uniformity of amplitude and high frequency, but the modula- tions of the amplitude of the incoming audio oscillations due to the microphone transmitter, being within the range of the human ear, are heard in the telephone receiver as articulate speech.

**Wireless Telephone Transmitters.**—The transmitters for this work necessarily require high current strength in the transmitter circuit. This develops heat in the carbon granules of the microphone transmitter, which leads to packing of the carbon. This impairs or stops the transmission of voice waves. The packing can be broken up by tapping the transmitter at suitable intervals, and De Forest provides a special device for this purpose. In other cases a device consisting of a number of tubes leading from a single mouthpiece to a number of transmitters, all acting upon the one circuit, is employed. Fessenden uses a special trans- mitter for this work, by means of which a current strength of 15 amperes is modulated successfully. For aeropeone service during the war transmitters of special design were found to be necessary if successful results were to be obtained. In this service, besides difficulties due to packing, precautions had to be taken to annul engine, propeller and other external noises. To this end the diaphragm of one type of transmitter is so constructed as not to re- spond readily to air vibrations below 200 or above 2,000 per second. In another type a perforated plate is interposed between the speaker's mouth and the diaphragm of the transmitter, which device haffles the movement of extraneous sound waves toward the dia- phragm while the voice waves spoken directly into the mouthpiece are not impeded. Still another device employed in this service con- sists in leaving the back of the transmitter open in such a way that exterior noise impinges on the back and front of the diaphragm of the transmitter with equal strength, effecting no result, whereas the voice waves hit the dia- phragm in one direction only and thus set up the required variations in the transmitter circu- it, even although at such times the pilot or observer cannot hear his own voice.

**Three Electrode Vacuum Tube Oscillator.**—As previously intimated the De Forest three electrode vacuum tube is now used as a source of high frequency sustained oscillations, and many different arrangements of circuits have been designed to utilize this remarkable feature of these tubes, now in practice frequently designated vacuum tubes or VT's. One such arrangement of circuits to obtain sustained oscillations is shown in simple form in Fig. 4, termed a vacuum tube oscillator. It illustrates the "feed back" or "regenerative" coupling of circuits, perhaps first devised by Armstrong. $F$ is the usual filament, $G$ is the grid, $P$ is the plate of the tube proper, $B$ is the heating or lighting battery, $r$, $r'$ are re- generative or feed-back tuning coils. $C$ is a condenser across the filament grid-circuit. Closing the circuit or jarring the tube will cause an initial impulse or oscillation in the grid-plate circuit, including coil $r$. This
oscillation in turn reacts on the grid-filament and r circuit, which again reacts on the former circuit, thereby producing a feed-back or regenerative oscillating current in the tube that may be termed self-perpetuating. After a brief interval a steady sustained oscillation is produced. The coils r, r' and condenser C are adjusted to oscillate at a desired frequency in the usual way. By means of this tube oscillation from one-half cycle to 20,000,000 per second are now obtainable.

![Fig. 4.—Vacuum Tube Oscillator,§](image)

It has been noted by another writer in explaining the oscillating feature of these tubes that in order to set tube circuits into a state of radio frequency oscillation it is necessary that the connections be so made that the grid end of the grid inductance will be alternately negative and positive, as the plate end of the plate inductance is positive and negative. When the grid and plate radio frequency circuits are coupled with the proper phase relation any variation in voltage in either the grid or plate circuits will cause minute disturbance in the oscillation circuits, setting them into oscillation at whatever frequency they may happen to be adjusted to. For example, a slight variation of voltage in the plate circuit by any means whatever will cause its resonant circuit to oscillate at radio frequency, and the resultant current will act upon the grid circuit, setting it into action at the same frequency. The resulting radio frequency fluctuations of the grid potential will act upon the plate at the right time to keep the plate resonance circuit in a state of oscillation, and this state of affairs will continue so long as the proper supply of voltage and filament current is maintained, but not otherwise. The tube is able to generate alternating currents because of its amplifying properties. The energy delivered to the grid circuit in accordance with the actions just outlined will gradually increase in value until a maximum is reached, which is the maximum output the valve is capable of delivering.” Consult The Wireless Age, June 1919, p. 5, article on “Wireless Telephone Transmitter for Short Distance.”

In general De Forest gives the explanation of the vacuum tube oscillator as follows: “There is only one oscillating circuit. This circuit is such that a sudden change of potential impressed on the grid of such a character as to produce in turn an opposite change of value of potential on the plate. Thus the to and fro reciprocal and self-sustaining. In some respects the operation of the vacuum tube oscillator is perhaps the simplest of any class of circuits. A well defined example of a self-perpetuating circuit is that due to placing a telephone against the mouthpiece of a transmitter when a shrill whistle or howl is established. This phenomenon is noticeable in the transmitter and receive acousticon type. This effect is said to a series of reactions somewhat similar but much more complex than those in an electric door bell, another device self-perpetuates its own vibrations; a circuit is closed by the push-button case of the telephone howler let us explain its operation that a movement of the diaphragm of the receiver toward the net tends to weaken the diaphragm of the transmitter and hence the pressure of the carbon of the latter. This causes a weakening of the tension, allowing the diaphragm of the receiver to fall away, with the further result that the column is compressed, this tending to increase the pressure on the carbon again and increase the current strength in the diaphragm of the receiver, which actions are repeated over and over. Investigation of this phenomenon, as might be expected, that it is upon the fundamental set of vibrato receiver and transmitter, the length of column enclosed between them and oscillation period of this circuit. To references the attraction of the diaphragm of the receiver and to its falling perhaps rather broad terms, when considered that as near as can be calculated the amplitude of vibration of the said diaphragm reproducing speech is about the on millionth of an inch. While this pl has no direct bearing on the vacuum oscillator it is interesting as somewhat thereto and hence may tend to explanation of the device.

Colpitts Vacuum Tube Oscillator, and Repeater.—In Fig. 5 is shown a circuit due to Colpitts of a vacuum telephone transmitter with other circuits for providing a high vacuum tube oscillator, modulator and of radio and audio frequencies. In the circuit the circuits into which is put is termed the input circuits; it give out energy, the output circuit, the input circuit consists of the vacuum tube VT, modulator coil r, and filament F, as indicated by the. The output circuit indicated by consists of the plate P, filament F, coil T, and battery B, tery supplies current to plate P, the diode or choke coil K; b is pha battery. The secondary wire in series with the secondary of an transformer T' is to the

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§ oscillation

---
ne transmitter circuit TC as shown.

Arrangement acts as a generator of high

currents by reason of the interaction of the
input and output circuits through the
transformer T and the circuit SC. These
generator currents are modulated by the
frequency currents due to the operation of
the phone transmitter TC through the trans-

cords T, T', and are transmitted by the
transformer or repeating coil T into the line.

![Diagram of Colpitts' Oscillator, Modulator and Repeating Device](image)

**Fig. 5.—Colpitts’ Oscillator, Modulator and Repeating Device.**

detection increases with the signal strength. Thus the receiver usually works out best in
seven stages, three radio, one detector and three audio stages. Properly designed sets of this
kind operated non-oscillating and without regeneration, will give signals more than 10^6
times as strong as would be obtained with a simple one tube detector. By using a regenera-
tive feedback much higher amplification can be realized, but the operation becomes less
stable.

The degree of amplification due to the
vacuum tube amplifier varies under different
conditions of battery, circuit connections, etc.
In the case of an amplifier made for the United
States Signal Corps, the power of the output
signal was from 40,000 to 60,000 times that of
the input signal. In general it may be taken

![Diagram of Receiving Circuit with Detector and Two-Stage Amplifier](image)

**Fig. 6.—Receiving Circuit with Detector and Two-Stage Amplifier.**

The incoming oscillations are detected by
VT and are successively transformed and
amplified by transforming T, vacuum tube VVT,
VVT'; telegraph or telephone signals being
ed in the telephone receiver TR.

*Fig. 7.* From an article on “Radio Frequency Flicker” (in *Electrical World*, p. 570, 22
1919), “to build a reliable and efficient circuit of more than three stages at any one
ductor that the increase in audibility is according to
the square of six per amplifier. Thus if one
amplifier increases audibility six times, two
amplifiers will increase it 36 times, and so on. It
has been stated that by *the use of successive
vacuum tube amplifications, energy increases of
10,000,000,000,000 times have been obtained and
that a six stage amplifier permits the feeble
energy derived from a telephone receiver
when employed as a transmitter to light an ordinary tungsten lamp, or to produce a spark-
ing potential of several thousand volts. The amplifying power of the vacuum tube is, ho-
ever, not an instance in which something is seemingly obtained for nothing. In this re-
spect it is not comparable to the microscope or telescope. Rather, as pointed out by Batsel,
its amplifying effects are obtained in a manner analogous to the increase of power in a
direct current generator due to an increase of current or potential in the field circuit of the
machine, which in turn increases the density of the magnetic field in which the armature
rotates. The increased power in the dynamo output is disproportionately greater than the
increase of current in the field circuit and is supplied by drawing upon the mechanical
energy that revolves the shaft of the dynamo. Analogously the batteries that supply the heat
for the filament and the electric potential for the plate are drawn upon to supply the power
developed by the vacuum tube. In the case of the direct current generator the power is con-
trolled by the magnetic field; in the vacuum tube the output is controlled by the grid
potential through the agency of an electric field.

The transmitting and receiving vacuum tubes employed in wireless telegraphy and telephony
are differently constructed and require varying amounts of current. Thus one type of receiv-
ing tube used by the United States Signal Corps requires for filament operation 1.1 ampere
supplied by a four-volt storage battery, while the plate circuit is supplied by a 30-volt dry bat-
tery of 15 cells. The filament in the transmitting tube takes normally 1.30 amperes at
seven volts. The battery for the plate circuit of this tube ranges from 250 to 350 volts. The
power output of this tube is three to five watts. Consult article by Broad (Electrical
World, 22 Feb., 1919).

Wireless Telephony in Aerial Service—
The exigencies of the Great War led to rapid development in wireless telephone apparatus
and methods for army and navy needs in this country and abroad. There was especial need
for wireless telephony in the aerial service and great progress was made in meeting these
demands. For the latter purpose apparatus of minimum weight was necessary. The dimen-
sions, for example, of a complete outfit for the
use of the United States Signal Corps containing vacuum tubes, transformers and plate
circuit dry batteries are nine inches by seven
inches by five inches, and it weighs eight pounds.
The input transformer used in this set is of the shell type, wound with 6,000 feet of No.
40 stranded wire with paper insulation between the layers of wire, and weighs two
pounds.

In Figs. 7, 8, respectively, are given illustrations of transmitting and receiving types of
three electrode vacuum tubes used by the United States Army and Navy signaling de-
partments of the late war. In Figs. 9, 10 are illus-
trations of transmitting and receiving wireless telephonic sets utilized by the
United States Signal Corps. Wireless tele-
phone communication between flying in the air and between the planes and
stations; also by means of wire telephonic
between the men in the airplane itself,

becoming of more importance toward the end of the war, and many valuable improve-
ment were developed to facilitate this con

Fig. 7.—Receiving Type Vacuum Tube.

Fig. 8.—Transmitting Type Vacuum Tube.
Multiple Wireless Telephony. — In wireless telegraphy the term duplex telegraphy signifies a system in which two messages are sent over wire simultaneously in opposite directions. Duplex telegraphy is meant the sending of two messages in the same direction over one wire simultaneously. The term multiplex telegraphy usually covers telegraph systems by which more than two messages are transmitted on one circuit at the same time in either direction. In wireless telegraphy the term "duplex telegraphy" is applied to means by which wireless messages are sent in opposite directions at once from two wires on one supporting tower, or preferably from two wires separate towers, and again preferably with respective transmitting and receiving aerials distributed a distance of 25 or 50 miles, in which latter case the transmitting and receiving apparatus are connected by land wires, making it possible to localize the transmitting and receiving operators in one room. The usual adjustments of the wireless apparatus made by attendants at the transmitting and receiving antenna. Utilizing remote control throughout the operation during the late war, the high-power wireless transmitter stations at Annapolis, Md., Eckerton, N. J., New Brunswick, N. J., and Asheville, L. I., were operated by four operators one room in the Navy Department building, Washington, D. C.

The term multiplex wireless telephony may be utilized as mentioned in the case of plex wireless telephony, but preferably it refers to the sending of two or more wireless messages simultaneously from different antennas near-by stations, say, ships of a fleet, and reception on the antenna of different ships a fleet at a distance. One of the best known multiplex telephone systems for this purpose is the Gray Harmonic Multiplex Telegraph system, formerly in use on land lines.

The Gray Harmonic Multiplex Telegraph.—By means of this system it is possible to transmit over one wire simultaneously four or more messages by means of electrical vibrations. In this system four tuning forks of different rates of vibration, say, 204, 320, etc., per second, are each given control of a battery by contact points suitably fixed on the forks. These batteries are arranged in series in a main line circuit. The tuning forks are kept in constant vibration by an electromagnetic device similar to that of the ordinary electric door bell, the forks being used as the armature of the magnet. When in operation these forks open and close the circuits of their respective batteries at a rate corresponding to the fundamental vibration of the forks, and thereby set up four different trains of electric impulses in the main line circuit, of frequencies equal to those of the respective vibrating forks. A Morse telegraph key is arranged to control the impulses set up by each fork in such a manner that a series of short and long electric pulsations corresponding to the dots and dashes of the Morse telegraph alphabet may be transmitted over the main lines by each key.

At a receiving station four electromagnets are placed in series in the main line circuit. The armatures of these instruments are iron reeds, fastened at one end, and attuned to vibrate at rates corresponding with their respective vibrating forks at the transmitting station. Hence, each reed will select and respond only to the pulsations of current transmitted by its respective vibrating fork. Contact points controlling a local current are also attached to the armatures of the receiving magnets and by this means the transmitted dots and dashes are received by a Morse telegraph sounder in practically the usual way.

Obviously, when all of these differing rates of current impulses are being transmitted at one time over one wire the resultant composite wave must be complex to a degree. Yet the Gray Harmonic telegraph system was in successful operation for several years between New York and Chicago on the lines of the Postal Telegraph Company. Indeed the degree...
of complexity of the resultant current referred to did not end with the operation of the functions outlined in the foregoing remarks. For, in addition to the four pulsatory circuits mentioned, an ordinary Morse duplex system was superposed on the vibrating system, this giving a sixplex telegraph system capable of transmitting six messages over one wire simultaneously.

The Heising Multiplex Wireless Telephone System.—In this system an arrangement measurably analogous to the foregoing is employed for setting up electric oscillations of different frequencies, which differing rates of oscillations are simultaneously radiated as a compound wave in space from the aerials of nearby transmitting stations and are selected and received at the receiving stations by suitably attuned wireless apparatus, in a manner to be described.

This system was installed experimentally on three or more ships of the United States navy, but owing to the declaration of war with Germany the tests were prematurely discontinued. The transmitting apparatus on one ship is outlined in Fig. 11. The apparatus on all the ships was similar, but certain of the tuning circuits on each ship were adjusted to different rates of oscillation. The plan employed is to transmit from the three ships a carrier wave of 25,000,000 cycles (150 meters). Then on one ship to modulate this frequency with an intermediate wave of 25,000 cycles, which frequency in turn is modulated with the waves due to speech. On another ship the same procedure is followed except that an intermediate wave of 35,000 cycles is employed and on the third ship an intermediate wave of 45,000 cycles is utilized.

Let Fig. 11 represent the ship (A) using wave modulates at $R$ the amplitude of the 25,000 cycle frequency set up by the oscillator $V'T$. In turn this modulated 25,000 cycle frequency after amplification in power tube $R$ is, through transformer $T'$ caused, at condenser $C$, to modulate the 2,000,000 cycle carrier wave developed by oscillator $V'T$. This does not modify carrier wave after increased amplification by the tube $V'T'$ is delivered to the transformer $T'$ to the antenna $A$. Batteries and other devices used in this system are not shown in the figure.

To avail of this arrangement each of three ships or other stations equipped with this apparatus will transmit a carrier wave 2,000,000 cycles. But one ship, say $A$, modulate this wave with a 25,000-cycle wave and $B$ will modulate it with a 35,000-cycle wave, and $C$ with a 45,000-cycle wave. The receiver $A'$ will tune his apparatus to a 2,000,000-cycle wave and to an intermediate frequency of 25,000 cycles. Ship $B'$ will tune his apparatus to a 2,000,000-cycle wave and to an intermediate wave of 35,000 cycles, and ship $C'$ to 2,000,000-cycle wave and to an intermediate wave of 45,000 cycles. The receiving apparatus is indicated in Fig. 12. $A$ is the aerial which encloses the 2,000,000-cycle tube and the appropriate tuning coils $T_C$ transformers $R_C$ and condensers $C$. Brackets $m$ encloses the intermediate frequency and detector tube $V'T$, the telephone receiver and the usual filament and potential battery. It is plain then that the receiving apparatus of the ships $A'$, $B'$, $C'$ will only respond to 25,000, 35,000, and 45,000 speech modulated radio waves, respectively, while all three receive and detect the 2,000,000 carrier wave practically as the vibrating reeds in the Harmonic Telegraph system respond only

![Fig. 11.—Heising Multiplex Telephone Transmitter System.](Image)
TELEPHONY, WIRELESS

ously in the same neighborhoods, using carrier waves of say, 189 and 190 meters in length, in addition to the wave 150 meters, and by modulating each of the two additional carrier waves with the frequencies of 25,000, 35,000 and 45,000 where it will be feasible to carry on separate wireless conversations simultaneously. The tubes $VT'$, the output circuits of which in turn are coupled through transformer $RC'$ to the input circuits of a battery of three power tubes $VT$. Similarly the output circuits of the latter tubes are coupled through the transformer $RC''$ to the aerial $A$, from which the modulated high frequency oscillations amplified and increased in power are radiated into space. $BB$ in the figure indicate the usual heating and potential batteries. The power tubes, it will be noted, are connected in quantity or multiple and not in series or cascade as in the case of amplifier tubes. See Fig. 6.

Long Distance Wireless Telephony.—An epochal series of experiments in long-distance wireless telephony was in 1915 conducted by the American Telephone Company in conjunction with the Western Electric Company and representatives of the United States navy and the French army. The most notable of these tests were perhaps those made between Arlington, Va., and the Eiffel Tower, Paris. Tests had been previously made between Arlington and Darien, 2,100 miles overseas, and between Arlington and Mare Island, near San Francisco, 2,500 miles overland. In the Arlington-Darien experiments speech was transmitted from New York City by land lines to Arlington, whence it was transmitted by wireless telephony to Darien. In the Arlington-Paris experiments difficulty was found in obtaining the use of the Eiffel Tower station, owing to the exigencies of the Great War which was then in progress. In these tests the Eiffel Tower station was used only for receiving. On 22 Oct. 1915, however, speech transmitted from Arlington to Darien for the first time over an English Channel wireless circuit was successfully received.
Arlington was clearly received in Paris, a distance of 3,600 miles. The radio-wave length employed was 6,000 meters. The antenna current employed at the Arlington station was about 50 amperes. The speech transmitted on this and other occasions was also received, and the voice of the speaker clearly recognized by the wireless operator in Honolulu, 4,500 miles from Arlington.

The general plan of transmission adopted at Arlington was somewhat similar to that indicated in Fig. 12, but of course the number and capacity of the senders and receivers and power tubes used at Arlington was greatly in excess of that used in shipboard or ordinary wireless telephone practice.

The Future of Wireless Telegraphy.—In view of the rapid development of wireless telephony within the past 8 or 10 years it would be unwise to attempt to place a limitation upon the extent of the use of this art within the next decade. The possibility of transmitting wireless telegraph messages a distance of 12,000 miles, from Carnarvon, Wales, to Sydney, Australia, has been demonstrated (2 Oct. 1918). Likewise the possibility of transmitting speech by ether waves a distance of 4,500 miles has been shown. These results are obtained by the use of the vacuum tubes oscillators and amplifiers. As a distance of 12,000 miles is half way around the earth and as the ether waves in traveling that distance traverse both sides of the earth, it follows that this is equivalent to transmitting a message from one point to any other point on the earth. Success in this method of construction of the three-electrode vacuum tube speech may be transmitted to any distance reached by radio-telegraph waves, it would seem that under favorable conditions it may be said that world-wide wireless telephony is now a possibility.

The high cost of very high-power vacuum tubes together with their low efficiency and limited durability is at present, however, likely to militate against their general use, but improvements in methods of construction of this apparatus will doubtless reduce its cost and increase its durability. The existing need of high and very expensive aerial wires in long distance wireless telegraphy and telephony is also a limiting factor to the extensive employment of these arts to very long distances.

Some of the chief obstacles to the extensive and successful use of wireless telegraphy and telephony in the past have been those due to statics and interference between or clashing of signals from different sending stations at nearby or even at remote stations. A great forward step toward the solution of this static problem is that due to the Weisen anti-static device. (See TELEGRAPH, WIRELESS). The interference problem is still to be solved.

It has already been noted, by the use of selective tuning devices, which only transmit and receive to waves or oscillations of a certain frequency, stations may cut out waves of other frequencies and thus avoid interference. Thus by the use of a standard wave length for certain circuits, as, following land telegraph practice, the other routes used by different wireless stations may be termed non-interfering; ether circuits may be and in fact are very generally at the present time, regular wave lengths for a given transmission circuit may be set at, say, 10,000 meters, and stations using that wave length in any part of that circuit to which the 10,000 meter length is assigned, would set up no or very little clashing of signals. It is known that a difference of 300 to 400 meters in wave length is ample to avoid interference between such stations. For instance, a 10,000-meter wave length station operating side by side with a circuit having a 10,400-meter wave length. For low wireless telegraph and telephone operation in other words, for high-power stations long wave lengths are essential. The minimum and maximum available wave lengths are, say, from 10,000 to 20,000 meters for distance signaling. Since the signals from very high-power stations are now recoverable over the world, it is obvious that if a wave length, say 400 meters, is required to prevent interference between any two such circuits, the total number of available wide wave lengths would be limited.

It may be noted that the short-distance signaling a difference in the wave lengths of about 20 meters is sufficient to prevent interference between such circuits. Even in short distance signaling, were all stations to adhere to an allotted wave length in any design, the number of available wave lengths ultimately would be reached. While the above conditions continue, the limitation of telegraphy and telephony will exist.

It is, however, not unlikely that methods in this branch of electrical science will render it possible to operate transmitting circuits without these limitations.

In wireless telephone interference nature does not occur as measures are taken to prevent such interference (termed it interference between circuits) by parallel wire transmission of telephone circuit. (See TELEPHONE). The effect of induction between parallel parallel wire transmission circuit is not as much as the receiving instruments employed on these systems are considerably sensitive to weak induction currents. Notwithstanding the real difficulties.
TELEPHOT—TELESCOPE

That may be termed universal wireless for social, commercial and other pur-
poses confidently expected by competent engineers and inventors that its utti-
sification is not beyond the possibility of actual realization. In the meantime telephony if only available, com-
fers for comparatively short distances, could be installed to great advantage.

**GRAPHY.**—Bucher, 'Vacuum Tubes in Communication'; Fleming, 'Radio
ography and Radio Telegraphy'; Goldsmith, 'Telephony'; Mauer, 'Wireless Tele-
d Telegraphy.'

WILLIAM MAVER, JR.,
'American Telegraphy and Encyclopedia of the Telegraph.'

Fig. 1.—Astronomical Telescope.

**TELEPHOT, or TELEPHOTO,** any one of theoretical instruments designed to
pe scenes at a distance by photography aid of electricity. Telephotography an interesting field for inventors, but
erially successful machine has been

**ESCOPE.** The telescope is an optical at which the image of a distant
magnified so that it may be examined were but a fraction of its actual dis-
the observer. This instrument was
by the Dutch optician, Lippershey, the 17th century. The first use of it
onomical observations was made in
Galileo, who in 1609 invented the
form of reflecting telescope, called the Casse-
granian, invented by Cassegrain in 1672. The
optical principles here are the same as in the
Newtonian form except that the convergent
cone of rays from the mirror A is intercepted by a convex reflector B and sent back through
an opening in the centre of the mirror A to

Fig. 2.—Newtonian (eye-piece on side of tube).

Fig. 3.—Cassegrainian (secondary mirror convex).

The many and widely varying forms of telescopes may all be grouped simply as tubes
(Milton, seeing Galileo's in Florence, called it
the "Optik Tube"), in which are placed the several combinations of lenses or reflectors;
each combination, however, producing the one
result, namely, first, gathering the light from the object and concentrating it at the focus in a
brilliantly illuminated but small image; and,
second, magnifying this image with a micro-
scope called an eye-piece. One of the common
types is the refracting astronomical telescope
(Fig. 1), in which A is the object-glass or
objective, and F the focus, where the small
image is formed. The two lenses, C and D,
form the microscopic eye-piece, which mag-
nifies this image. The first reflecting telescope
was the Gregorian, invented in 1663 by James
Gregory. It has not survived. Fig. 2 repre-

---

*Fig. 1.* Astronomical Telescope.

*Fig. 2.* Newtonian (eye-piece on side of tube).

*Fig. 3.* Cassagrainian (secondary mirror convex).
TELESCOPE

1780, had a mirror 48 inches in diameter and a tube 40 feet in length.

In these forms of telescope the image of the object as seen through the eye-piece is necessarily inverted, which is, of course, unimportant in astronomical observations, but is a defect to be overcome in the terrestrial instrument. The most common type of terrestrial telescope is the Spy Glass (Fig. 4). The objective A has the same office as in the refracting astronomical telescope, and forms an illuminated image of the object at the focus F. This image is then magnified by a compound eye-piece made up of several lenses B, C, D and E, which carry the light to the eye in such manner as to erect the image and show it in its natural position. Fig. 5 represents the piece which would give a power of 3,600 diameters. Such high powers are, however, seldom required and can be used only in the clearest atmosphere. By far the larger proportion of astronomical observations are made with powers of less than 1,000 diameters. In telescope observations, the two elements "power" and "light," while equally important, are always in opposition. Thus an object viewed with

Galilean telescope, which is the same in principle as the ordinary opera glass. In this case the objective A condenses the light from the object observed, and would naturally make a small image at F, but the cone of rays, before reaching the focus, is intercepted by the double concave eye-piece C, and thence conveyed to the eye in erect position. Fig. 6 shows the Porro Prism instrument, the most modern and efficient form of terrestrial telescope. The objective and the lenses are in the same relation to each other as was first illustrated in the astronomical telescope, Fig. 1. Two double-reflecting, 45-degree prisms are inserted within the cone of rays between the eye-piece and the objective (Fig. 6); their mission being to erect the image which, in the ordinary refracting telescope, is shown inverted. This system was the invention of the Italian engineer, Porro, who patented it in France about 1890.

The magnifying power of telescopes is usually expressed in diameters and is indicated by the ratio of the focal length of the objective to that of the combination of lenses forming the eye piece. For example, the Lick telescope has a focal length of 50 feet or 672 inches. If, therefore, an eye-piece of one inch focus is used the power of 100 diameters is four 1800 diameters, and eye-pieces of longer shorter focus will give correspondingly lower or higher powers. The practical limit of power in telescopes of the highest degree of accuracy is usually considered to be about 100 diameter per inch of aperture. Thus the 36-inch Lick telescope may be practically used with an eye-piece which would give a power of 3,600 diameters. Such high powers are, however, seldom required and can be used only in the clearest atmosphere. By far the larger proportion of astronomical observations are made with powers of less than 1,000 diameters. In telescope observations, the two elements "power" and "light," while equally important, are always in opposition. Thus an object viewed with

FIG. 4. — Terrestrial Telescope (spy glass).

FIG. 5. — Galilean Telescope (opera glass).
The focus of its own. The red light is refracted, reached its focus in the yellow ray, then the green and yellow points at the centre, sur-
round of green and blue light.

This difficulty in refracting light is called chromatic aberration, checked by a mixture of green and blue light.

This diagram E is a double-convex lens in glass and D a flat-glass lens of nearly spherical form. The difference between them is that a single material in light refraction dispersion, together with the compensating of the two lenses, results in clear and distinct "definition," the image of the star being sharply outlined and colorless. Optical glass is of special manufacture. The D's supply comes from three makers, one in England, France and Germany. The mirror or objective is made of several thin lenses cemented together, usually in number of four in number, alternatively crown and flint glass. Some are using for lenses successfully, though with much difficulty. The mirror or portion in the case of very large discs. The reflecting surface is ground and polished, with great precision, to a parabolic form of the focus required, and then, by a chemical process, coated with silver, which may be easily renewed when tarnished or otherwise injured.

The making of the optical parts of telescopes is a rare art, which, however, has been cultivated with peculiar success in America. Alvan Clark and Sons of Cambridge, Mass., have been exemplified in this connection during the lifetime of the firm, and the SUNY. At the present time the largest reputation as a maker of large telescopes belongs to John A. Brashear of Pittsburgh, Pa.

The telescope tube is usually carried by an equatorial mounting. This form of instrument has its principal or polar axis set parallel to the axis of the earth, its inclination, therefore, corresponding to the latitude of the observatory. At right angles to the polar axis is the declination axis, which, in turn, carries the telescope tube at right angles. Each axis is supplied with a graduated circle, indicating, respectively, the position of the star in hours, minutes and seconds of right ascension, and in degrees, minutes and seconds of declination. It will be evident that when the tube is pointed to a star in any part of the visible heavens, a revolution of the polar axis from east to west, in sidereal time, will make the telescope follow the apparent motion of the star. A driving clock, which is usually located inside the column of the instrument, controls the revolutions of the polar axis so that the star observed remains steadily in the field of vision. The equatorial principle has been applied to photographic telescopes in such manner as to allow the continuous exposure of the photographic plate during the entire night, if desired. One of the most ingenious forms of mounting is the Equatorial Coudé. In this instrument the polar axis is enlarged so as to serve as the main tube of the telescope, the eye-piece being at the upper end where the observer can sit comfortably in his warm room and observe any star in the visible heavens as easily as he uses his microscope.

An elbow is rigidly attached to the lower end of the tube. At the intersection is an accurately polished mirror set at an angle of 45 degrees. At the outer end of the elbow is another mirror, similarly set. The objective is so placed that the light it gathers from the star is reflected by the mirrors through the tube to the eye-piece. The combined movement of the polar axis (the telescope tube) and the objective and mirror carried on the elbow enable the observer to bring into view any star in the visible heavens. The polar axis, with its elbow carrying the objective and revolving in sidereal time by means of a driving clock, follows the apparent motion of the star in the usual way. Two of these instruments are in successful use in the Paris Observatory.

It will be evident that the equatorial telescope, with its various modifications as above described, while giving facility of moving and photographing the heavenly bodies, does not enable the astronomer to determine with required accuracy the positions of the stars and planets. These fine measurements are secured only by special forms of telescopes. The Me-
ridian Circle is one of the most approved instruments for this purpose. From the middle of the tube trunnions extend on either side, carrying finely graduated circles and terminating in accurately ground pivots, which are exactly at right angles to the optical axis of the tube. Two piers are so set as to form a rigid and accurate support for these pivots, east and west, carrying the tube so that the movement of the telescope is in the true meridian only. In the exact focus of the telescope a fixed system of cross-hairs or wires is placed. The best materials for this purpose are taken from the cocoon of the field spider, the web being only one five-thousandths of an inch in diameter. Finely drawn platinum wires are also used. These vertical spider webs are equally spaced and so adjusted that the central wire is exactly in the optical axis of the telescope as measured north and south. Parallel to these central wires there are two movable wires, one horizontal and one vertical, each governed by a micrometer screw. In measuring transits of stars for determining right ascension, or for time, the telescope, by means of the graduated circles, is set to the declination of the star required, and when the star appears, its transit across each of the wires is recorded on a chronograph, by the observer tapping an electric key. In determining declinations, the telescope, by means of the graduated circles, is set to the approximate declination of the star to be observed, and when the star appears at the edge of the field, the observer carefully adjusts the telescope until the star seems to be exactly bisected by the horizontal wire as it threads its way across the field. By reading the fine circle the declination of the star is obtained. Other types of telescopes for similar observations are known as transits, zenith telescopes, mural circles, etc., but the illustrations given will suffice.

Even with all the caution used in the construction of these delicate instruments, errors are sure to develop, due to refraction, flexure of the tube, variation resulting from changes in temperature and other contributing causes, for all of which allowance must be made in the final reduction of the observations. About the middle of the last century Professor Airy, then Astronomer Royal at Greenwich, designed and constructed a vertical telescope, which he believed would eliminate the errors so manifest in his other instruments. He named it the “Refract Zenith Tube.” The principle is shown in Fig. 7. Every part of the instrument is stationary and no part need be touched when in use by the astronomer. The light from the star as it passes the zenith is concentrated by the objective upon a surface of mercury in the base of the column, by which it is reflected back through a hole in the objective; the cone of rays then meets a diagonal prism, is reflected at right angles and enters the eye-piece to be observed as in other instruments. Contrary to the expectation, the Astronomer Royal, from the observed position of the stars were still manifest and the most careful investigations failed to trace them to their source. The instrument was, therefore, discarded. Fifty years later, Professor Chandler, of Cambridge, Mass., discovered that the pole of the earth “wobbles” slightly, causing a variation in latitude. The results of his observations were compared with the Airy observations of a half century before and the supposed errors of the “Refract Zenith Tube” were at once traced to the variation in latitude. The old instrument which had been condemned is thus proved to be correct in theory and practice. It, therefore, re pronounced the latest development in astronomical telescopes, and a large Refract Zenith Tube is in the service of the University of Pennsylvania.

In recent years the mounting of great instruments has passed from the domain of the instrument-maker to that of the engineer, who finds abundant scope for ingenuity and technical expertise in combining very massive and rigid, construction with very delicate means. At the present time the largest telescopes in the world are owned and made in America.

The table on following page gives a list of the larger refracting telescopes in the equator of the more important American observatories.

While the refracting telescope still holds advantages for photographic astronomical work, the tendency of late years has reverted to the reflecting telescope for visual work. Astronomers prefer it because of the much crisper images obtained, due in large part to the absence of the secondary spectrum images formed by the best refractors has turbid quality as compared with the crispness of the reflector. As in the case of the reflecting instruments America leads in the largest reflectors. The largest of all is
TELESCOPE

The 100-inch Hooker Telescope, Mount Wilson Observatory, Pasadena, Calif.
TELESCOPE

<table>
<thead>
<tr>
<th>Name of observatory</th>
<th>Aperture of telescope</th>
<th>Maker of objective</th>
<th>Maker of mounting</th>
</tr>
</thead>
<tbody>
<tr>
<td>University of Chicago</td>
<td>40 inches</td>
<td>Alvan Clark and Sons</td>
<td>Warner and Swasey</td>
</tr>
<tr>
<td>University of California</td>
<td>36 inches</td>
<td>Alvan Clark and Sons</td>
<td>Warner and Swasey</td>
</tr>
<tr>
<td>Hauteville Observatory</td>
<td>25 inches</td>
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<tr>
<td>Vienna University</td>
<td>20 inches</td>
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</tr>
<tr>
<td>Pennsylvania University</td>
<td>18 inches</td>
<td>Alvan Clark and Sons</td>
<td>Warner and Swasey</td>
</tr>
<tr>
<td>Munich Observatory</td>
<td>16 inches</td>
<td>John A. Brashear</td>
<td>Warner and Swasey</td>
</tr>
</tbody>
</table>

The reflecting telescope of the Mount Wilson, Pasadena, Cal., with a clear aperture of 100.4 inches (2,549 meters) and a focal length of 507.5 inches (12,891 meters) can be used directly on the axis of a focal planet. The observations were made in the form of a Cassegrain instrument focal length of 1,060 inches (40,792 mm) as a Coude with focal length of 126,191 inches (76,480 meters). Celestial objects to 53° south declination can be at the principal focus. The telescope after the English fashion, the tube containing the mirror at its swinging between the sides of the axis yoke, which has a bearing at resting on cast-iron pedestals built the main concrete pier below. It was designed by Mr. Pease and other of the observatory staff, assisted by Schwamb of the Massachusetts Institute of Technology. The pier is 33 feet high and forms the intersection of the axes of the ground. Both the declination and tension bearings are composite; in part, and of type, serving to define the axes, remainder carries the load. The load is carried by means of counterweights while the polar axis is supported by means of steel drums built integral axis and floating in cast-iron tanks. It becomes necessary that the total moving weights to 100 tons are constructed of cast and structural and in 1,328,000 as machined as a whole. The larger portion of the mounting, some weighing 10 tons, in Quincy, Mass., and their transposition to Mount Wilson to an elevation of 0.7 feet in diameter, 100 feet high and weighs 730 tons. The rotating portion weighing 300 tons is carried on 28 trucks and is traction driven by two motors at opposite sides. The trucks and rails are carefully machined to conical surfaces to eliminate vibration at the telescope when the dome is moved. The shutter is in halves which open sideways and permit the free viewing of the telescope from the zenith to the horizon. The walls and dome are of double construction and are ventilated at the top to prevent excess heating during the summer. A 10-ton crane is provided to assist in the erection and in the traverse of the various auxiliary sections of the tube.

The second largest reflector in the world is the 72-inch instrument set up in 1918 on Little Saanich Mountain on Vancouver Island, British Columbia, in the Dominion Observatory there. The mirror of this instrument was ground by the John A. Brashear Company of Pittsburgh, from a disc of glass cast in Belgium and shipped out of that country two days before the war broke out. The mirror is parabolic, 13 inches thick at the rim with a hole 104 inches in diameter through its centre. It weighs 4,340 pounds and has a focal length of 30 feet. Observations may be made from the side of the upper part of the tube, from the side at the lower end or through the opening at the centre of the mirror. The telescope with all its fittings weighs 55 tons and is moved by an amount of electric current barely sufficient to light a 16-candle power electric lamp. The mounting was built by Warner and Swasey. The only other telescope of this size in existence is that of Lord Rosse set up upon his estate in Ireland in 1842. It's first mirror was of specu-
lum metal and was replaced by a 72-inch silvered glass mirror in after years. For a long period it was the largest telescope in the world; but was abandoned for optical reasons.

There are three 60-inch reflectors in the Western Hemisphere, the newest one erected at the National Observatory of the Argentine Republic near Cordoba. The mirror was made by the John A. Brashear Company in 1916. In 1904 Harvard University purchased the 60-inch reflector made by Dr. A. A. Common of Ealing, England. This instrument is of the Cassegrainian type and has a rectangular tube. The mounting is peculiar, the telescope being supported in position upon the end of a hollow cylinder which floats in a well or deep basin of water. The cylindrical float is 18 feet long and seven and two-thirds feet in diameter and arranged to float constantly at an angle with the horizon equal to the elevation of the celestial pole at Cambridge—about 45 degrees. The instrument weighs over 20 tons, but is so delicately balanced that it may be moved in any direction with the greatest ease by its electrical controls. The eye-piece of the instrument is detached from the telescope and housed on the second story of an adjacent building, the light from the principal mirror being directed to it by accessory mirrors.

The 60-inch reflector of the Mount Wilson Observatory, constructed by Dr. Ritchey in 1908, was placed in commission in December of that year. The instrument complete weighs 21 1/2 tons, nearly all of which is ingeniously supported upon a float in a basin of mercury, of which it displaces the equivalent of 50 cubic feet, although the entire amount of mercury in the basin is but 635 pounds. The controls are electric and may be manipulated from several stations about the instrument.

Another fine telescope which should be mentioned in this connection is the 48-inch reflector built by Sir Howard Grubb and located at Melbourne, Australia.

For more detailed descriptions of these wonderful instruments and their achievements the files of the astronomical journals are recommended.

Worcester Reed Warner, F.R.A.S.,
Of the Warner and Swasey Company, Cleveland, Ohio.

TELFORD, tel'ford, Thomas, Scottish engineer; b. Eskdale, Dumfriesshire, 9 Aug. 1757; d. Westminster, 2 Sept. 1834. At 14 he was apprenticed to a mason and on the expiration of his time worked as a journeyman at that trade, but subsequently removed to Edinburgh and there applied himself to the study of architecture. In 1782 he went to London, where he was befriended by Sir William Pulteney, through whom he was appointed surveyor of the public works in Shropshire. He now became a civil engineer and in 1793 was entrusted with the construction of the Ellesmere Canal, to connect the Mersey and Severn. In 1803 and 1804 the Parliamentary commissioners for making roads and building bridges in the Highlands of Scotland, and also for making the Caledonian Canal, appointed him their engineer. Under his superintendence 1,200 bridges, two of 150 feet span, were built, and 1,000 miles of new road were made; and under the latter board the Caledonian Canal was constructed.

Under other commissioners he built over harbors, some of which, as at Aberdeen and Dundee, are upon an extensive scale. He also employed in England, superintending the construction of the bridges over the Severn, of eight canals, and the execution of numerous important works for the metropolis.

In 1808 he was employed by the Swedish government to lay out a system of inland navigation through the central parts of Sweden to form a direct communication by water between the North Sea and the Baltic. He built the road between Warsaw and Brest Litovsk in Poland. The greatest monument of his engineering skill is the Menai Suspension Bridge, connecting Caernarvonshire with the island of Anglesea, which was opened on Jan. 26, 1826. In 1828-30 he superintended the drainage of nearly 50,000 acres of the country. He invented the Telford pavior for making roads, and the improvement of which practically any instrument with great precision and sweetness.

TELL, tel', William, Swiss peasant, born in Burglen, near Altorf, celebrated in legend his resistance to the tyranny of the Austrian governor, Gessler. The stories connected him with those relating to the origin of Swiss Confederation, first appear in the 16th century. According to them, Gessler, the rennalous Austrian bailiff of Uri, one of the forest cantons, pushed his insolence so far as to require the Swiss to uncover their heads to his hat (as an emblem of the Austrian sovereignty), and condemned Tell, who refused to comply with this mandate, to shoot an arrow from the head of his own son. The Swiss were successful in his attempt, but confessed that a second arrow, which he bore about his person, was intended, in case he had failed, for punishment of the tyrant, and was, therefore, retained prisoner. While he was crossing Lake of the Four Cantons, or Lake of Lucerne, in the same boat with Gessler, a violent storm threatened the destruction of the skiff, as the most vigorous and skilful helmsman set free, and he conducted the boat safely near the shore, but seized the opportunity of spring upon a rock, pushing off the larch, and had fortunately taken his bow with him, when the governor finally escaped the rescue, and reached a rocky defile on the road to Küssnacht. Tell shot him dead. The death of Gessler was the signal for a most obstinate war between the Swiss and Austrians, which did not bring to a close until 1499. Tell is present at the battle of Morgarten, and is supposed to have lost his life in an inundation of 1350, while attempting to cross the river. Tell is the legendary hero of William Tell. In the Teller family to this day the name is honored.

Investigation has broken down the proofs of this
There is no mention of him by any orantiane historian; his name is first h in the chronicles of the second half 5th century, and none of the Tell ball- of an earlier date. Similar stories to those of the apple occur in rammticus, the Danish historian, and ndic literature, not to mention the old ballad of Adam Bel, Clym of the and Wyllam of Cloudesle. Besides, y the mountains, dates and places, and the widely ; representations of the event, show the development of the legend. The untrr- istry of historical scholars has not been d by the finding of the name of Tell archives and church registers of Uri, and an uninterrupted series of charters relative to the bailiffs or governors of the 14th century, there is no Gess- ing them. The Tell chapels were erected early in the 13th century and mentioned in the document which speaks of the as in 1388 of 114 persons who knew him is, and of the erection at that time of chapel on the shore of the Lake of gene, not known until 1759. Consult 'Recherches Curiées' (1843); Roch 'Tell und Gessler in Sage und Ge' (1877); Gisler's 'Die Tellfrage: Ver- rer Geschichte und Lösung' (1895).

ITZELAND. History.

J. L. CITY, Ind., city in Perry County, Ohio River, 125 miles southwest of In- lish on the Southern Railroad. There are large coal and clay in the vicinity, auarturers include furniture, iron prod- ucts, flour and tobacco. The city named by the Swiss Colonization Society. Pop. 3,869.

J. L. EL AMARNA, Egypt, a district east bank of the Nile, 190 miles above compris ing the site and environs of the city of Akhenaton, known also as Akhet-Aton, built by Amenophis later was known as Akhenaton or Aton. The city was built by Amenophis 1800 BC and was the capital of the empire of thebes after he had abandoned the of Ammon for that of Aton. It grew but was abandoned upon the death of the owner returning to Thebes as and to the worship of Ammon. The important ruins are those of the palace House of Rolls, and there are remains of their. About 300 clay tablets contain records of the time of Amenophis father were discovered in the House 1887. To the northeast and to the f the ruined city are tombs hewn in the hills which abound in sculptured picturing mainly the worship of the Aton.

The tomb of Meri-Ra, high priest of Amun, is in a ravine near the river and the south Consult Petrie, F., 'Tell el-Amarna' Davies, N. C. G., 'Rock Tombs of Amarna' (1903-08); Peake, W. M. F., and Egypt from the Tell el Amarna (1898).

TELL EL KEBIR, Egypt, village in the northeastern portion of the country, on the Sweetwater Canal, 18 miles southeast of Zag- azig. It was the scene 13 Sept. 1882 of a battle between the English forces of Lord Garnet (later Lord Wolsey) and the Egyptians under Arabi Pasha, which resulted in the utter defeat of the Egyptians.

TELLER, tél'ær, Henry Moore, American senator: b. Granger, Allegany County, N. Y., 23 May 1838; d. Denver, Colo., 23 Feb. 1914. He was educated at Alfred University, New York, taught school, and after admission to the bar practised law in Illinois and Colorado. He was United States senator from Colorado 1876-82, Secretary of the Interior 1882-85, and a member of the national Senate from 1885, except for a brief interval 1896-97, up to 1909. He was especially prominent as a silver advocate, and had the unusual experience of serving his constituents as a nominee of the Republican and later of the Democratic party.

TELEZ, tél'yäth, Gabriel Spanish dramatic author, better known by his pseudonym, El Maestro Tirsø de Molina; b. Madrid, between 1570 and 1572; d. Soria, 12 March 1648. He studied at Alcala and remained for some time at Toledo, whence some of his works are dated, also in Galicia and in Seville. The date of his profession as a Brother of Charity is unknown, but we know that he had become superior by 1619. In 1634 he was named De- fensor general of Castile. His first poetical work, 'Los Cigarrales de Toledo' (1624), is a collection of tales in which there is a resemblance of the influence of Boccaccio. This influence is clearer in 'Los tres maridos burla- dos,' which is an admirable adaptation of the 'Decameron.' Instead of a second part of the 'Cigarrales,' promised by the author there appeared in 1635 a new collection ('Deleitar aprovechando') of religious stories mixed with 'Autos,' of which 'El Colmenero divino' is one of the best efforts in religious drama. For a long time Téllez devoted himself to this species of composition. In 1620 he dedicated to his friend Lope de Vega 'La Villana de Vallecas' and four years later he stated that he had written well nigh 300 comedies. He excelled in the religio-theological and historical period and also in historic dramas, farces and comedies d'intrigue. He had a penchant for epigram but was capable of reaching the highest conceptions and frequently sounded tragic depths. Some of his works are equal to Cal- deron's or Lope's best and in recent years critics have begun to do him full justice. An eloquent proof of his merit is that some of his works have been attributed for centuries to Lope or to Calderon of which was the case of 'El Burlador de Sevilla y Convidado de Piedra,' an admirable scenic portrayal of the legend of Don Juan, which, although universal as proved by Farinelli, has taken on the character of a purely Spanish legend through this work of Téllez, which has been widely imitated in other literatures. It is his best work and in order of importance may be mentioned 'La prudencia en la mujer'; 'Marta la piadosa'; 'El vergonzoso en Palacio'; 'Don Gil de las calzas verdes'; 'El amor de los amantes,' and 'La villana de Vallecas.' It has been said that his feminine characters are
lacking in amiable traits. He was to a great extent the model of the stylistic vices of his period and was often imitated by Calderon. It is difficult to comprehend the obscurity into which his works and reputation fell soon after his demise. To-day we possess about 80 of the 400 pieces we know came from his hand. He also wrote numerous lyrical works including: 'Genealogia del Conde de Sástago' (1640); 'La Cronica' of the Brothers of Charity. (See EL BURILEON DE SEVILLA.) The best editions of his works are: those of Augustin Durán, of Hartzenbusch, 'Teatro escogido de Tirso de Molina' (12 vols., 1831-41); by Romános, (1848); and Rivadeniera 'Comedias escogidas de fray Gabriel Téllez.' Consult Cotarelo, C., 'Tirso de Molina: Investigaciones bio-bibliográficas' (Madrid 1883); Morel-Palau, A., 'Etudes sur le théâtre de Tirso de Molina' (in Bulletin hispanique 1900); 'Nueva biblioteca de autores españoles' (Madrid 1906-07); Armesto, 'La leyenda de Don Juan' (ib. 1908).

TELLICHERRY, tel-i-cher'i, or TELLI-
CHERRY, India, a seaport and garrison town in the Malabar district of Madras, 45 miles northwest of Calicut. The main buildings include the castle—now a jail—the North Malabar district court, custom-house, churches and government offices. The entire area, on a picturesque site, covers about five square miles. The principal exports are sandal wood, coffee and cardamoms, spices, cocoa and cocanuts. The factory of the East India Company was founded in 1663. There are missions and other schools; also Brennan College founded in 1862.

TELLURIC, an element discovered by Mueller von Reichenstein (1782) in a specimen of gold ore from Austria. Klapproth named it from the Latin tellus, meaning the earth. Tellurium is most commonly in company with gold, silver, lead and bismuth. Native tellurium is found in considerable quantity in Boulder County, Colo. The other important minerals containing tellurium are sylvanite, calaverite, pelzite, hessite and tetra-
dymite, and were found principally in Austria, and in the United States in California and adjacent States.

Tellurium is a silver-white metal, atomic weight 127.6, melting point about 453° C. and specific gravity 6.25. It is brittle, not changed by exposure to the air and when heated a little above its melting point it boils and condenses again in the cool portion of the retort as metallic drops. In chemical properties it is very like sulphur. It unites with chlorine readily, forming TeCl₂ and TeCl₄. The oxides TeO₂ and TeO₅ are analogous, yet differ considerably from SO₂ and SO₃. Tellurious and telluric acids and the salts derived from them are also known. Tellurium forms a compound with hydrogen, analogous to H₂S and possessing an even more disagreeable odor. This element resembles sulphur in imparting very undesirable properties to metals even when present in very small amount. If tellurium and any of its compounds are introduced into the human system they give the breath a very strong and disagreeable garlic-like odor. To obtain the free element the ore is digested first with sulphuric acid; hydrochloric acid is then added in small quantity and the whole treated with sulphurous acid which precipitates the tellurium as a yellowish compound.

TELFERAGE, tether-áj, or TELPH-
ERAGE, system of aerial transportation, in a cable or elevated railway, by electric power arranged for automatic operation. Both system and the word 'telferage,' as means 'distance carrying,' were introduced by the late Fleming Jenkin. He recognized cases in which the electric motor could be adapted to automatic transportation of materials and he devised a system which when into service gave satisfaction. This consisted of two overhead cables, mounted on stout poles along which light carriers were hauled, each means of one or more electric motors, transmitted current to the motors the cables are cut into sections, adjacent sections of one being insulated from each other, but are converted, with sections of the other cable, to form two continuous conductors, lying alternately on the right and left of the system. The trains were somewhat longer than the sections of cable so that one rested on one conductor while the other was on the second, thus completing the electric circuit.

Modern telferage systems are more elaborate than Jenkin's. As usually constructed, the light steel framework supports a system of elevated cables, from which buckets or cars are suspended, hanging on wheels on the rails. Small electric motors are placed on the carriers. The current is transmitted to the motors by means of a small trolley wire carried over the running cable or rail. Sometimes a double trolley system is adopted. The trolley or towing vehicle is usually equipped with motors. These may be placed on the side of the cable or side by side. The driving wheels are mounted directly on the axles, as gears are not used. The carway is attached to the trolley or to a post and is often fitted with a third motor for balancing the load. Where heavy loads are to be carried two supports may be used, each by one or more running wheels. Where the system is not automatic it is controlled from station or an operator is carried with the car. Where the weights to be transported are light, wire cable is employed, and often the cable is supported between the rollers by a suspension cable. In any case a rail is used stead of a cable when a corner is to be made and in running through buildings where cable construction would be difficult, or when the weight and traffic is sufficient to make the cost.

The advantages claimed for the telferage system are economy in cost of transportation and a capacity for moving large quantities of material with a low cost of operation compared with a railway. Further, they may be erected overhead and out of the way. Telferage systems are now used in many works of all kinds for carrying materials building as well as outside. The system is also adapted to other work, such as excavating trenches, canal construction, etc., (See Clark, Chas. M., 'Telferage,' Trans. American Institute Electrical Engineers (XIX, p. 391).

TELU GU, tel-oo-goo, or TELINGA, lan-
guage of India, belonging to the Dravidian
TEMULAND—TEMPERANCE

I spoken by about 20,000,000 of people in Hyderabad, Mysore, Bombay, Cen-
neces, Burma, Berar and other parts. They are the most numerous branch of the "Indian race", but are less enterprising than the English, who occupy the country to the west. The language is allied in roots and grammar, but differs considerably from the older Indian languages.

See INDIA; TAMIL.

The ULAND, tém'bú-land, South Africa, is the eastern part of the Cape Province, which is situated on the coast of the Indian Ocean, one of the Transkei districts, Pondoland and Griqualand East; and Umtata. Pop. 232,000 (5,179 Euro-

TITLE, tén-os, a sacred plot of land marked off and consecrated to the gods. Any tract of land allotted to a sanctuary.

1SVAR, tém'esh-vár, Hungary, on the Canal, 75 miles northeast of Belgrade. It is a citadel and suburbs — four in all. Noteworthy are the castle, cathedral, and several vineyards. Some of the notable art treasures include wooden goods, oil, acce, leather, etc., and there are grain stores, etc. The fortress has sturdy walls; memorable is that of 1849, when it was invested and bombarded by the international forces. Pop. about 72,500.

2E, tém'pé, Vale of, in Thessaly, Greece, on the Peneus, flanked by the Mount Ossa. It has been immortalized by the poets.

2ERA. See DEISTER; MURAL; PAINTING, TECHNIQUE OF.

PERAMENT, in music, the system of tuning voices or instruments with the rule of fixed tones, adopted since the middle of the 19th century and first advocated by J. Sebastian Bach (1685-1750). In the equal or even temperament, the interval is the mean semitone, that is, half an octave. This neutralizes all harsh discords of uneven temperament, except those that exist among all of the voices or instruments, so that the true intervals become octaves and the key scales 12, the relative pitch levels of the ideal scale being fixed and modulated or tuned in pure or perfect temperament. No further adjustment is necessary, if these tones only are used. Modulation to another key, however, requires that the new tone be so chosen that the original one shall be equal and one or more passing notes vary to arrive at the key desired (see also Temperament). Temperaments are classed as: 1. Well-Tempered (Clavier). Some of the more important temperaments are: 1. Well-Tempered (Clavier), 2. Equal Temperament, 3. Just temperament.

PERANCE. This word has long been the characteristic of the movement for the restriction of the use and sale of alcoholic beverages. The records of all the early peoples of the world contain references to the evils of intoxication. The Buddhists, Taoists and Confucians taught temperance. "Look not upon the wine when it is red nor at the last it biteth like a serpent — and snares like a fisher." (Prov. xxiii, 31-32). The ancient philosophers and founders of the great world religions neither taught nor practised total abstinence and these conditions have not been as widely followed. The temperance movement in America in the 18th century. In 1743 Lord Lonsdale made a speech in the House of Lords, urging the necessity for a temperance reform. The first work of temperance reform was in 1760 Smollett called the attention of the English people to the dangers of "drunkards" and "dead drunk for 2d." He made an urgent appeal for reform in the condition of the low alehouses. Yet it was not until 1829 that record is found of a temperance society in Great Britain, at New Ross, County Wexford, Ireland. In 1830 several temperance societies came into being in English cities and the British and Foreign Temperance Society was founded in 1831. It lasted until 1850, but in the meantime its work was taken up by others. Father Theobald Mathew (q.v.), of Cork, Ireland, began his campaign for temperance about 1838 and within three years he gathered about him more than 4,000,000 followers. The best evidence of the thoroughness of his work is that the consumption of liquors in Ireland fell off one-half during the period of his activity. In 1843 he was called to England and in 1850 to America, where he founded the numerous Father Mathew Total Abstinence Societies. There had been considerable temperance agitation in the States before Father Mathew's arrival. The Washingtonian movement started in Baltimore in 1840 and John B. Gough (q.v.) had begun his wonderful talks for temperance. The influence of Father Mathew was evident in the formation of the Independent Order of Good Templars, founded in 1851 in Utica, and spreading rapidly all over the United States and to foreign countries. A woman's crusade for temperance started about 1870 and crystallized in the National Woman's Christian Temperance Union, founded in Cleveland in 1874 and now having 12,000 local unions throughout the United States. Frances E. Willard (q.v.) who was prominent in the work, founded the world's Woman's Christian Temperance Union in 1883, and it has become the largest and most influential movement for temperance and prohibition. It can scarcely be said, however, that the United States has led in temperance societies. In fact, the number of societies organized, doubtless partly because her territory is so widely distributed. A list of prominent temperance societies in 1905 included United Kingdom 14, Germany 12, Australia 11, Switzerland 11, United States 10,
Temperance agitation has influenced legislation for 75 years, but still the use of intoxicants is tolerated in many communities. As a result temperance agitators have gradually come out stronger and stronger for prohibition of both the manufacture and sale of intoxicants and the temperance movement has merged into the Prohibition movement. The prohibition was the work of the more radical reformers. See Prohibition.

Temperance Legislation.—Legislation against the liquor evil in America dates from 1642, when the colony of Maryland passed a law making drunkenness a misdemeanor, punishable by a fine of 100 pounds of tobacco. As sentiment against intoxication developed, the license system was adopted, as a temperance measure, being popular in communities also because it furnished a revenue for the local government. Soon the license system won the approval of the liquor sellers, for it stopped competition in their business, resulted in uniform prices, and therefore contributed to money-making. Though advanced and introduced by advocates of temperance, the license system was fostered and grew directly through the efforts of the liquor-sellers. Temperance workers then began to advocate no license and a vast amount of legislation developed in the different States over licenses, their revocation or suspension, at the will of the people. Restrictive legislation took the form of local option laws and after the War of 1861-65 the local struggles at the polls of half the cities and towns in the country for years were centered mainly about the question of license or no-license. The establishing of local option in a community had a tendency to drive the lovers of liquor to the neighboring towns where there was license; thus the temperance towns lost their license fees, and saw their churlish citizens going to other places to drink and also to trade. Often the result was that the financial pressure caused a return to license. There was wild license with no-license and no-license almost all over the country. The first State to recognize that this irregular system could be overcome only by the States acting as a unit was Maine, which in 1851, under the influence of the Gough and Mathew movements, adopted State local option, and as a State continued to refuse to license the liquor traffic. Kansas and North and South Dakota followed, and in 1881 Maine placed the prohibitory clause in her constitution and ended the agitation for a return to licensed liquor-selling.

But in other States the contests at the polls continued regularly. Indiana was the first State to pass a local option law in 1832, and several of the States passed such laws before the Civil War. By 1900 one-third of the country was under local option, and in 1911 local option existed by enactment in 33 of the States. Between 1880 and 1910 appears to have been the most active years with States having with little laws to restrict and regulate the liquor traffic. Most of the States passed Sunday closing laws, though allowing the hotels to sell liquor to their customers with meals. There was legislation permitting wives and children of drunks to bring civil suits against any selling liquor to their provider. There were laws locating of saloons within so many churches, schools or polling places. Laws were largely honored in the breach, closing never working effectively in cities, except spasmodically. The chief of police became active. Prohibition opened the back door as was and is (1918) the common practice in large cities. In country towns the selling on Sunday is confined to the men known personally to the proponent. The effort to improve conditions in the evil was equally ineffective. When proposed the argument was that nine out of ten saloons would go out of business, the evil would be confined to those who had the liquor habit and who would drink. This proved to be sophistry. The evil got more money by the high license tax than by the liquor forces to be active in politics, until in very many towns a man could rarely be chosen at all unless he was acceptable to the interests. A perpetual difficulty with obtaining license was the varied methods of evasion by all these various methods of evasion that they failed to strike at the source of the evil, the transportation of liquor. Maine prohibited liquor selling for agents of the United States government, and obtained large sums in revenue from it. Maine, entered into Maine, carried there with it to stop it, by the express companies. A form of nullifying the no-license law was the establishment of liquor agents. This proved to be prohibitory in its effect, because it became apparent to the most obtuse that the manufacture and consumption of liquor in the United States had a slow and steady increase for these years of antagonism, up to 1913, since which date there has been a very slight per capita reduction. The per capita consumption of malt liquors past 100 years in the United States steadily increased up to 1907, after which time there was a decrease. The per capita consumption of distilled liquors has been in decline since 1865. There has been a decrease until 1913, since which time has been justifiable. But this decrease in consumption of distilled liquors was in a change in habits, for the latter grew as the population increased, and the use of hay and other beast feed as a substitute for corn to increase the volume of liquors sold being always on the increase and the falling off then appeared to be due to financial stringency and to moral support to local option or block it, or prevent its enactment or to encourage it. The end of the trade was unharmed.
TEMPERANCE, SONS OF—TEMPERING

Sons of Temperance, or THE OR-der of Sons of Temperance, was founded in the city of New York, in 1842. It is composed of subordinate and national divisions. It has four divisions—one for North America, one for Britain and Ireland and two for Australia. The course of its existence it has had 4,000,000 members on its rolls. Its leading and inalienable principle is total abstinence from all intoxicating liquors and bev-

ERMANCE LEGISLATION. See Temperance Societies. See Temperance, Sons of, or The Order of Sons of Temperance.

PERATURE. See Heat; Thermometry; Thermodynamics.

PERATURE OF THE BODY. See Heat.

PERATURE VARIETIES. See Heat.

PERATURES, Underground. See Heat.

PERERING, the art of imparting to any means of heat treatment, a definite of hardness. The term is now applied exclusively to certain kinds of steel used in the manufacture of tools. It is the art of hardening and tempering; but this art, if ever really existed, is lost. The effects of thermal changes vary greatly with the quality of the and with the exact nature of the treatment. It is necessary to distinguish clearly between annealing and hardening and tempering. (Except those varieties that are with silicon, tungsten and certain other elements) may be annealed, but it is easy that the steel shall contain a certain amount of carbon, in order that it may be annealed and tempered. If steel to a red heat and is then allowed to cool slowly, it becomes relatively soft, so that an iron and turned in a lathe. This is called "annealing," and it has usually been shown, for example, by the work of Brinell, Tschernoff, Le Chatelier, la, and others that steel which had a dangerous crystalline character when in a slightly oxidizing, that long continued heating at high, have its original structure and as restored by the simple artifice of it, to a certain critical temperature. This temperature is about 1,600° F., and then allowing it the rate of cooling, in this case, being of comparative unimportance. Steels sometimes have which do not need treatment to render them fit for use in certain classes of tools; the tool being ready for use after it has been forged and allowed to cool by natural exposure to the air. In general, however, a tool steel must receive special treatment in order to fit for the work in hand: this treatment being given after the tool has been forged to shape. The process of tempering then consists of two steps, the first of which consists in imparting to the cutting edge of the tool a degree of hardness that is too great for the work for which the tool is to be used, while the second step consists in reducing (or "tempering") this hardness, until it attains a value that experience has shown to be satisfactory. The tempering of an ordinary tool may be described as follows: The finished tool is heated to a bright red, care being taken to have the heat extend back some distance from the cutting edge. The cutting edge of the tool is then immersed in water to a slight depth and kept there until it has cooled sufficiently to remain wet when withdrawn from the water. By this means the steel is rendered exceedingly hard throughout the chilled part; that is, in the vicinity of the cutting edge. If it were used in this condition, however, the edge would be too brittle and would be likely to fail on service. To reduce the hardness to the proper value, the tool, immediately after being withdrawn from the water, is brightened up near the cutting edge with a piece of emery cloth, or in some similar manner, and the cleaned area is then watched while the heat from the unquenched part spreads toward the cutting edge. The oxidation of the steel, as the edge becomes hotter and hotter from conduction, causes a play of color to become visible, which serves as an index of the temperature. These colors run from the hot portion of the tool toward the quenched cutting edge. In the order in which they proceed, they may be described as: pale yellow, straw yellow, brownish yellow, light purple, dark purple and blue. When the proper color reaches the cutting edge, the whole piece is again quenched, and the "tempering" is complete. The colors that are used for different implements are as indicated below:

Very pale yellow (about 430° F.): Steel-engraving tools, turning tools, hammer faces, planer tools, wood-engraving tools.

Straw yellow (about 460° F.): Dies, taps, drills, punches, reamers.

Brown yellow (about 500° F.): Gouges, plane irons, twist drills, cooper tools, wood-boring cutters.

Light purple (about 530° F.): Augurs, surgical instruments, cold chisels, edging cutters.

Dark purple (about 550° F.): Axes, gimlets, needles, hack-saws, screwdrivers, springs, wood-saws.

Some tools are of such a shape that they cannot be tempered in the manner here described, but must have their temper "drawn" to the desired color by reheating the piece between hot iron plates, or in a hot iron ring. Springs are often tempered by a different method, known as "oil tempering." In carrying out this method, the piece is first hardened by heating to a bright red heat and then tempering by plunging the whole piece in water or in oil. The article to be tempered is then wetted with oil and gradually and uniformly heated until the oil upon it blazes up, when the piece is again quenched in the oil. This process of
heating to the ignition point of the oil and then quenching is repeated until it has been performed three times, after which the piece is said to be properly prepared for use.

In the early days of steel-working in the United States, it was common to import water in casks from Sheffield, England, for hardening and tempering purposes, as it was believed that there is some special virtue in the water that had been used for so long, and with such eminent success, in that city. There was probably little or no foundation for this belief, and yet it is known that substances that may be in solution in the water that is used for quenching often have an important influence upon the product. Many artisans dissolve salt or cyanide of potassium in the water that they use for this purpose, and there is considerable ground for the belief that such dissolved substances do exert an influence upon the character of the product, which is out of all apparent proportion to the strength of the solutions containing them. In particular, it may be noted that there is a deeply-rooted belief among blacksmiths and other artisans who work with metals that a piece of iron is improved by heating it and then quenching it in water that contains soap, even in small amounts.

The art of tempering cannot be adequately presented in a short article, and those who are skilled at it maintain (probably quite justifiably) that the only way to learn it is by actual experience in the shop. Different steels may require radically different treatment, and special implements (razors, for example) may call for years of study before they can be tempered satisfactorily.

A LLAN D. RISTEEN.

TEMPEST, The. Although certain internal evidence, notably the verse-test, has caused most scholars to believe that 'The Winter's Tale' was the last of Shakespeare's plays, there will always be reason in thinking that 'The Tempest' (written in 1610 or 1611) best represents the final mood of Shakespeare as he turned from the writing of his plays to the last years of his life in Stratford. It is certainly one of the group of romantic comedies which Shakespeare wrote after the completion of his tragedies; and in the character of Prospero we are warranted in seeing an admixture of Shakespeare's personality as he looked out upon the world from the heights of his later years. He, like Prospero, broke his wand and buried his book deeper than did ever plummet sound. After all, while life may be tragic as presented in the series of plays from 'Hamlet' to 'Timon of Athens,' it is also full of sunshine and humor and the forgiveness of enemies and the reconciliation of the forces of good and evil. 'The Tempest' is such a representation of life. While some of the scenes of the play suggest definitely Milan and Naples, Tunis and the intervening Mediterranean Sea, the enchanted island upon which Prospero is ready for action is as far removed from the uncharted deep that voyagers were braving within the compass of man's imagination. In the grotesque figure of Caliban, the magic of Prospero and the spirit-like world of Ariel, there is the atmosphere of the strange world that stood out in definite contrast with the fixed limits of the European world. More particularly, Shak

in the Bermudas a few weeks after the vessels of the New World, he was indebted to "Stylist's Journals," the discovery of the Bermudas, published Professor Alden has recently made contention that the real source for the story of the storm and for the that take place upon the stra

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Virginia. While, as has been

might have heard from return stories of this wreck and of the

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found in a letter written by William dated 15 July 1610, and which, published until 1625, was, from evidence, seen by Shakespeare. The between the play and the letter are interesting and certainly tend to show that indebtedness to contemporary sou

in the Bermudas, published Professor Alden has recently made contention that the real source for the story of the storm and for the that take place upon the stra

greater than has been generally supposed. An ideal commonwealth suggested by it while based upon Florio's true Montaigne's essays, a new edition was published in 1610, and resembles to conditions in the Virginia as portrayed in the letter.

However far one may go in the ace of these parallels, the play is none the less creation of Shakespeare's genius, lacking in the perfect technique of s-play, and especially in the closeness of the structure, it is a great poem and itself to allegorical interpretation of the plays. Caliban is a monumental presentation of a primitive type of human being in unrestrained freedom and saturnalia of license. Ariel, more than any other, represents the spiritual forces of nature, the domination of superior will the service of man. Prospero, his magical art and in his intellectual and greatness, is an anticipation of the victory of man at his best over all of the world. There is no greater Shakespeare than the words of Prospero, looking out from the earth which he has reached, expresses the truth about man and the universe:

"We are such stuff

As dreamers are made on, and our little life is rounded with a sleep."

EDWIN

TEMPLAR, Knights. See M.

TERNITY, THE.

TEMPLE, Frederick, I archbishop of Canterbury: b. Ionian Islands, 30 Nov. 1831; d. 17 Dec. 1902. He was the son of an officer who died while he was under his mother's care was well youth, so that he obtained a "double" Oxford and was elected Fellow in his college. He went to the University of Oxford and took charge of Kneller Hall, Twickenham, 1848 to 1858 was school insp

in the latter year he was made headmaster and became one of the most pow

influence. Successors of Arnold: the position of 'Essays and Reviews.' In Temple led off with 'The E
roused a storm of acrimonious con-
y, but did not shake confidence in the
ister of Rugby, who was appointed to
Exeter in 1869, was translated to
in 1885 and succeeded Archbishop Ben-
. Equally as schoolmaster and as
he was a strict disciplinarian. Unfor-
worker, a blunt, just and sincere man
plainness of address did not obscure
sive learning with which his mind was
The great controversial storms of the
had spent their fury in the English
before he reached the primacy, but
bemgency was not uneventful. The
rian movement was in its last phase of
and Temple handled ritualists with
and moderation. He took part in the
diamond jubilee (1897) and in 1902
the crown on the head of her successor.
rings are 'Sermons in Rugby Chapel'
pton Lectures for 1884 on 'The Rela-
tween Religion and Science,' of which it
said that they were up to the standard
published after his death. His 'Miscel-
ney of the future primate of All Eng-
ed in harness, never recovering from
ort he made in a strong appeal in the
of Lords uttered in favor of the public
 on bill.

MPLEx, Oliver Perry, American law-
daughter: b. Green County, Tenn., 27
20. He was graduated from Washing-
lege, Tenn., in 1844, and admitted to the
1846. He was a Union leader in East
see during the Civil War; was a chan-
of Tennessee, 1866–78, and retired from
in 1881. His publications include 'The
, 'The Cavalier and the Puritan'
; 'Union Leaders of East Tennessee'
, etc.

MPLEx, Richard Carne, English civil
antiquary: b. Allahabad, India, 15
850. He was educated at Cambridge.
. He served in the Burma War 1887–
received a medal for bravery. From
he was engaged by the Indian govern-
o raise and fit out volunteer regiments,
 is 'Legends of the Panjand' (1883–90),
d is a member of philological and other
societies.

MPLEx, Sir William, English states-
London, 1628; d. Moor Park, Surrey,
1699. He was educated at Cambridge,
x years on the Continent and returning,
and not choosing to accept any office
Cromwell, occupied himself in the study
ory and philosophy. On the Restora-
was chosen a member of the Irish con-
, and in 1601 was returned for the
of Carlow. The following year he was
ted one of the commissioners from the
'parliament to the king, and removed to
. On the breaking out of the Dutch
 employed in a secret mission to
hop of Munster who had their headquarters
the satisfaction of the ministers that
following year he was appointed resident
ses, and received a baronetcy. With
he concluded the treaty between Eng-
, and Swedish (February 1668),
view to oblige France to restore her
conquests in the Netherlands. He also at-
tended, as Ambassador Extraordinary, when
peace was concluded between France and Spain
at Aix-la-Chapelle, and subsequently residing
at The Hague as Ambassador, enjoyed the
friendship of De Witt, and also of the Prince
of Orange, afterwards a great figure in the
pital led to the recall of Temple in 1671, who,
refusing to assist in the intended breach
with Holland, retired from public business, and
employed himself in writing his 'Observa-
tions on the United Provinces,' and part of
his 'Miscellanies.' In 1674 Temple was again
Ambassador to the States-General, in order to
negotiate a general pacification. Previously to
its termination in the Treaty of Nimeguen (in
1678), he was instrumental in promoting the
marriage of the Prince of Orange with Mary,
oldest daughter of the Duke of York, which
place in 1677. In 1679 he was recalled
from The Hague, and shortly afterward was
elected to represent the University of Cam-
bridge in Parliament. In 1680 he retired from
public life altogether. He was on friendly
terms with William III who occasionally visited
him. (For his relations with Swift see
SWIFT, JONATHAN). His 'Memoirs' are impor-
tant as regards the history of the times, as are
likewise his 'Letters,' published by Swift after
his death. His 'Miscellanies' consist of essays
on various subjects: 'Gardening,' 'The Cure
of the Gout,' 'Ancient and Modern Learning'
(which provoked much controversy at the
time), 'Health and Long Life,' 'Differ-
ent Conditions of Life and Fortune,' 'Introduction
to the History of England,' 'Poems and
Translations,' etc. Consult Courtenay, 'Life of
Temple' (1836); Macaulay's 'Essay' and For-
ster, 'Life of Swift' (Vol. I, 1875).

TEMPLE, Tex., city in Bell County, on
the Gulf, Colorado and Santa Fe and the Mis-
souri, Kansas and Texas railroads, about 220
miles northwest of Galveston, and 35 miles
southwest of Waco. It was founded in 1882
by the Gulf, Colorado and Santa Fe Railroad,
and was chartered as a city the same year.
It is in an agricultural and stock-raising
region and has considerable manufacture.
The chief manufacturing establishments are
agricultural-implement works, cottonseed-oil
mills and cotton compresses, flour mills,
chewing gum and candy factory and lumber
mills. The city has handsome churches, public and
parish schools, Saint Mary's Academy, two
kindergartens, a business college, three large
hospitals and a public library. The four banks
have a combined capital of $580,000. Pop.
16,993.

TEMPLE, London, England, a district of
the city lying between Fleet Street and the
Thames, and divided by Middle Temple Lane
into the Inner and the Middle Temple, belong-
ing to separate societies (see INNS OF COURT),
each with its hall, library and gardens. The
name is derived from the Knights Templars,
who had their headquarters here. The
Two temples are separated by a wall from
the rest of the city, and have entrance gates
which are closed at night. The district is
occupied, with few exceptions, exclusively by
barristers and solicitors. In former times the
members of the Temple were famous for the
masques, revels and banquets which they gave in their halls. To these entertainments there are many allusions in the old poets; kings attended them, the bakers joined in them and danced. Among the famous members of the Temple have been Beaumont, Sir Walter Raleigh, John Ford, Wyckerley, Congreve, Cowper, Blackstone, Sheridan, Coke, Littleton, Clarendon, Somers and Eldon. Goldsmith was a member here, and here Charles Lamb was born and passed the first seven years of his life.

**TEMPLE**, a name applied in religious history particularly to the temple built by Solomon at Jerusalem as a House of the Lord, and to the temples which succeeded it, more especially the magnificent structure, erected by Herod the Great, which is often mentioned in the New Testament. Solomon's Temple was built with the aid of an architect and skilled workmen from Phoenicia. The temple was an oblong stone building, 60 cubits in length, 20 in width, and 30 cubits in height. On three sides were corridors, rising above each other to the height of three stories, and containing rooms in which were preserved the holy utensils and treasures. The fourth or front side was open, and was ornamented with a portico, 10 cubits in width, supported by two brazen pillars, Jachin and Boaz (stability and strength). The interior was divided into the most holy place or oracle, 20 cubits long, which contained the ark of the covenant, and was separated by a curtain or veil from the sanctuary or holy place, in which were the golden candlesticks, the table of the show-bread, and the altar of incense. The walls of both apartments and the roof and ceiling of the most holy place were overlaid with wood work, skilfully carved. None but the high-priest was permitted to enter the latter, and only the priests devoted to the temple service the former. The temple was surrounded by an inner court, which contained the altar of burnt-offering, the brazen sea and lavers, and such instituted utensils as were used in the sacrifices, which, as well as the prayers, were offered here. Colonnades, with brazen gates, separated this court of the priests from the outer court, which was likewise surrounded by a wall. This temple was destroyed about 586 B.C. by the Assyrians, and after the return from the Babylonish captivity some 70 years later, a second temple of the same form, but much inferior in splendor, was erected. Herod the Great rebuilt it, beginning the work about 20 B.C., of a larger size, surrounding it with four courts, rising above each other like terraces. This being the temple of the time of Christ possesses great interest. The lower court was a square, on three sides surrounded by a double, and on the fourth by a triple row of columns and was called the court of the Gentiles, because individuals of all nations were admitted into it indiscriminately. A high wall separated the court of the women, 135 cubits square, in which the Jewish females assembled to perform their devotions, from the court of the Gentiles. From the court of the women 13 steps led to the court of the temple, which was enclosed by a colonnade, and divided by 12 rows of columns, 4 on each side. The court of the Jewish men and the court of the priests. In the middle of this enclosure stood the temple, of white marble richly gilt, 100 cubits long and 60 cubits high, with a porch 100 cubits and three galleries like the first temple. It resembled in the interior, except that the most holy place was empty, and Herod's temple was double the height of Solomon's. Rooms appropriated for purposes filled the upper story above the inner temple. This edifice was destroyed by the Romans in 70 A.D., and for many centuries the long-consecrated height has been occupied by the Mosque of Omar.

The Egyptians, Greeks, Romans, and other ancient nations had temples to worship of their gods, and the Mexican Peruvians, at the time of the arrival of Spaniards in the New World, had temples. On the sacrificial platform of temples thousands of victims perished. The Greek and Roman temples were, as a rule, models of architectural grandeur and the word "temple" is sometimes, but not always applied to Christian places of worship as a special designation, although frequently used figuratively. The Mormons design the Temple, the largest in the world, in which they worship at Salt Lake City. Consult Gaskell, James, 'The Temple of the Jews' (1878); Smith, G. A., 'Jerusalem' (1908).

**ARCHITECTURE***

**TEMPLE, Order of the.** See (*Royal Temple***.

**TEMPLE BAR**, London, England. The arch on the Fleet street and the Strand, and divides the city from the liberty of Westminster (London). It was a structure of the Cotswold order, designed by Sir C. Wren, and built 1670 of Portland stone. Over the gateway, on each side, were statues of Queen Elizabeth and James I; and on the west side, of Catherine of Braganza and Anne. The heads of persons execute great treason were formerly exhibited on the gate. Here, also, on previous occasions if the corporation of London received the family, the heralds' proclamations, or any distinguished visitors. When the sovereign is in state the lord-mayor here delivered to the sword of state, which he bore after this he rode bareheaded, immense front of the royal procession. As the seriously obstructed a crowded throng there it was removed in 1878, its site now marked by the heraldic monster, a "<".

The gate has been re-erected at Park, Cheshunt.

**TEMPLE UNIVERSITY**, an institution of higher learning founded at Philadelphia, 1884. The first building was the old Temple College, later Temple University in 1917. It was designed by Russell H. Conwell, pastor of the Temple. It was chartered by the Pennsylvania legislature in 1888, and empowered to grant degrees, its name being changed from Temple College University. It offers instruction to young men and women, and academic to the highest university degree. Instruction is arranged in morning, and evening classes in all branches excepting music and dentistry, in which there are day classes. The university is non-sectarian in character.
f a strongly religious atmosphere, and shes a notable work in assisting those who do not otherwise obtain high educa-
vantages. In 1918 there were 321 in-
; 2,192 students attending and 306 with 78.
20 (time), in music, the relative rate or degree of quickness with which music is to be executed. The de-
time are indicated by certain words ento (slow), adagio or largo (leisurely) (walking pace), allegro (gay or quick), rapid), prestissimo (very rapid), etc.
2 is the proper time. (See Music).
'd is also used in chess to indicate the f a move, especially when the move is

TEMPORAL POWER

ITALY. See ANATOMY;

TEMPORAL POWER (OF THE POPE). A powerful expression, in it is generally recognized, and to a large extent the sovereign civil rule as exercised by the popes over the Church with varying vicissitudes middle of the 8th century down to the 0, when the last remnant of the papal as annexed to the United Kingdom of formal establishment of the temporalates from the year 754, when Pepin, the Franks, bestowed upon Pope 11 (who had sought his aid against the Lombards) independent sov-
over some 20 cities, thus constituting is henceforth known as the state or of Saint Peter. Though apparently at first—possibly unknown for on
of the Pope himself—this addition of ral to the spiritual rule of the bishop was in reality but the natural outcome of existing civil and political conditions. these may be mentioned the fact that itan Church was already in possession of a royal society, or simply as a body ; holding property under the general the empire) possessed not only the neteries now known as the Catacombs, other property, as is clear from the Milan. By a law of 321, the Emperor granted to all persons capable of will the the right to bequeath property to the Church, and himself gave an example in this respect by endowing munif-
se various basilicas of Rome. Similar in one form or another were made by Christians throughout the empire, one incipic uses to which the property thus was applied being to relieve the dis-
ioned by the depredations of the bar-
also began to overrun Italy. Since the
of the 5th century. In this way the Church had become very wealthy, and s were already great landed propri-
ing vast estates in various parts of

Italy and elsewhere long before any form of political papal sovereignty had been thought of. Meanwhile, through the favorable legislation of the Christian emperors, the political role of the popes and of bishops in general, was assum-
ing an ever-growing importance. The bishop of a city was not only the official protector of the poor, of prisoners and of slaves; he had also in virtue of his office a voice concerning various points of civic administration. Even in provincial affairs he enjoyed important rights and privileges. Thus, among other things, we find that appeal could be made from the decision of an imperial magistrate to the tribunal of the bishop. Such being the political status of bishops generally, it is easy to understand that the powers granted to and exercised by the Roman pontiffs were still more extensive. To them, in particular, recourse was had against the exac-
tions of the rapacious Byzantine governors who ruled in the different Italian provinces, and in this connection, as well as in other ways, the vigilant protection of the popes proved benefi-
cial to the people. It must be remembered that during this period the civil and political situation throughout the peninsula was in a condition bordering on the chaotic. The state of unrest and insecurity which resulted from the incursions of the barbarians and the deplorable inefficiency of the imperial adminis-
tration, made the interference of the popes in civil matters a real practical necessity. The Papacy was the only authority that commanded general respect, and the common weal demanded that they should look after the material as well as the spiritual interests of their flock. That such was the true condition of affairs is amply shown forth in the papal correspondence of the time, especially in the letters of Gregory the Great (590-604). It is also worth noting that though they had ever-growing reasons to be dissatisfied with Byzantine rule, the popes (even those who succeeded Gregory) continued to remain faithful to the idea of a world-wide Christian empire, and exercised their influence to maintain in Italy its authority and prestige. But, as is well known, many of the emperors of that period were more preoccupied with theology than with matters pertaining to civil administration, and their repeated attempts to impose upon the bishops of the West subtle formulas of orthodoxy led to frequent conflicts, in some of which popes were violently dragged away to prison or death. Thus Silvester and Vigilius, Pelagius and Martin became the victims of imperial tyranny. On the refusal of Sergius I to accept the decrees of the Emperor Justinian II the latter commanded the proto-
spatharius Zachary to arrest the Pope and bind him a prisoner to Constantinople, but the public spirit in Italy was already in revolt against this arrogant, high-handed policy, and the army interfered to prevent the execution of the imperial mandate. Again, in 727, Leo the Isian sent his edict against the use of images to Pope Gregory II with orders for his deposition in case he should refuse to comply. Gregory re-
ponded by denouncing the edict and excom-
municating the exarch; again the soldiers arose in his defense, and the imperial officials trembled at the prospect of being compelled to carry out their instructions cost them their lives. In 733 the emperor confiscated all the Church's estates in Sicily, Bruttium, Lu-
cania, Calabria and Naples; others were con-
fiscated by the Lombards, and no security remained even for the inhabitants of Rome. The empire was unable to defend its subjects — worse than that, it even oppressed and plundered them. The only refuge left to the Romans and the empire itself was the temporal head of the Franks. It is not clear whether Pope Stephen II in taking this step had already in view the establishment of a civil principality under his own ruler, or not, but that as it may, just then the relations between the papacy and the emperor were further strained by the publication of a fresh edict against the use of images emanating from a synod of Constantino-

A continuation of the old régime seemed no longer possible, the army of Pepin arrived in Italy in the summer of 754, and the independent state of Saint Peter was established, with the Pope as its civil ruler, in the same year. In view of the circumstances, it may be truly said that this distinction was bestowed upon the bishop of Rome in recognition of a twofold prerogative, namely, his prestige as head of the Church and defender of orthodoxy against Eastern aggression, and his character of national protector.

The papal dominion as constituted by the grant of Pepin comprised the cities of Ravena, Rimini, Pesaro, Fano, Casena, Forlì, Comacchio, and 15 other towns. In 1053 the duchy of Benevento was ceded, and for that period and the end of the 13th century the authority of the Roman See was acknowledged by many other free towns in Italy. In 1278 the Emperor Rudolf I confirmed the acquisitions made thus far, defined the boundaries of the papal states, and recognized the Pope's exclusive authority over them by absolving the inhabitants from their oath of allegiance to the empire. The papal dominion then included Perugia, Bologna, Lertinoro, the duchy of Spoleto, the exarchy of Ravenna and the marche of Ancona, but many of the towns were more or less independent. The Romagna was annexed at the end of the 15th century. Under Alexander VI and Julius II were added Faenza, Parma, Emilia, and Venetia, with the papal states receiving their final additions in the 17th century, namely, Urbino, Ronciglione and the duchy of Castro. In 1797 the Romagna was seized by Napoleon and incorporated into the Cisalpine Republic. The following year Rome itself was taken by the French and the papal states were erected into the Roman Republic. Pius VII regained possession of his states in 1800, but they were soon retaken by the French, and finally (1809) incorporated with France, Rome being reckoned the second city of the empire. After the downfall of Napoleon (1814) Pius VII returned to Rome and was formally reinstated in his office of temporal ruler by the treaty of Vienna, mainly through the friendly support of the powers of Russia, Prussia, and England. In 1830 a rebellion broke out in Ancona and Bologna, the reason alleged by the insurgents being that the clerical rule in the provinces contrasted too unfavourably with the preceding French administration. This revolt was quelled through the powers of Austria, Prussia, and England. In 1830 another uprising occurred soon after, and the Austrians took occasion thereby to occupy the northern legations, while at the same time the French placed a garrison in Ancona. Occasional minor disturbances occurred at these events and in 1848, when Pius IX, on the eve of an insurrection, was obliged to flee and Rome was declared a republic. He was again restored to power through the intervention of France, Austria, Siles, and the Austrians occupied legations or Romagna on his return, when their army was withdrawn, the province repudiated its allegiance and Pope and its annexation to Sardinia claimed. The French still continued Rome in subjection to papal authority IX, with a view to withstand any French advances, or the control of papal provinces of Umbria, Urbino, and the Marches in favour of Emmanuel. The Sardinian troops were the aid of the insurgents, and after two French troops having been withdrawn, the war with Prussia, Rome was put to an end without resistance, troops of Victor Emmanuel and the loss of temporal power disappeared. Emmanuel having been proclaimed king of united Italy, took up his residence in the palace of the Quirinal and Pius IX retired from a life of seclusion (in the Vatican) for himself as a prisoner unable to retreat without compromising his head of the Church, or even giving a single man to the cause of the insurrection. The meeting of the present article to appreciate the motives either of those who maintain the independence of the state of affairs has never yet received
nernational ratification. Furthermore, isivity, or even the utility, of such a on is a point concerning which there is ble divergence of opinion even among Catholics. It is a question concerning au thoritative dogmatic pronouncement formu lated by the Church; however, and unmistakable attitude of the popes : cannot be looked upon by Catholics t than deeply significant. All, even the a-montane, must, of course, admit that ssion of a temporal sovereignty is not r tial prerogative of the successor of xer, since for so many centuries before ishablished the Church was able to de-fulfil so efficiently her mission in the Yet this temporal sovereignty is re-y many as the means providentially es-to protect the necessary independence of the free exercise of his func- pondership of the Church. Others, mitting the main principle involved in that the Pope should be free in his cytoky) take a somewhat different the case. They remind us that t the power was the outcome of peculiar ge-tances of the period that it h best and perhaps the only solution at , and for centuries afterward of a problem, partly political, partly reli-it at the same time it is not proved that conditions been otherwise other day papal supremacy just as satisfactory post has developed. But be that as it is claimed that at least in the present d political conditions of the Christian of different from those of the Middle e desired independence in spiritual be can be secured without imposing on the burden of a temporal as well as al sovereignty. When, however, it is w this can be done, no very clear or nry answer is forthcoming. It is plain nature of the case, as well as from the sources—namely the sojourn of t Avignon—that to have the Pope: control or protection of any secular tances in Europe that the temporal he of the head of the Church be not him-independent sovereign, it is hard to a situation in which he would be free lue political or national influence, es-if he is to be either the subject or some temporal ruler. It is for a reason that the founders of the Amer- blic wisely determined that the seat of al or federal government should be ot in any of the States, but in a sepapendent district, exempted from States late, thus insuring greater freedom of the governing body whose duty it is to impor tially in the interests of the en-n. These and other reasons are urged d the 19th century by Frohny, J. W. 'T Italy from 1815 to 1861' (London 1891); Reumont, A. von, 'Geschichte der Stadt Rom' (Berlin 1870); Stillman, W. J., 'The Union of Italy, 1815-1895' (new ed., New York 1909); Tout, F. T., 'The Empire and the Papacy 913-1277' (new ed., London 1891); Vialot, 'La France et le grand schisme d'occident' (Paris 1896-1902).

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TEN COMMANDMENTS. See DECALOGUE.

TEN KATE, Jan Jacob Ludewijk, Dutch poet: b. The Hague, 1819; d. 1889. See KATE JAN JACOB LUDEWIJK TEN.

TEN THOUSAND A YEAR, a novel by Samuel C. Warren (q.v.) published in 1847. This story, though highly regarded by critics as "ridiculously exaggerated and liable to the suspicion of being a satire on the middle classes," has held a certain place in fiction for more than half a century. The plot is ingenious, the legal complications are managed in a way that won the admiration of accomplished lawyers and the story with all its faults conduced to arouse and maintain the reader's interest. In 1902 it was reissued in an abridged form as "Tittlebat Timmons."

TENACITY, the property or quality of resistance to disrupting force; the quality by which the molecules of a body resist either tensile or crushing strain. When the tenacity is slight the object may be brittle, when it is great it adheres together firmly. Compare TENACITY See STRAIN. See MATERIALS.

TENAFLY, N. J., borough in Bergen County. 16 miles northwest of New York, on the Erie Railroad. The Happy Land and Bethmore summer outing homes for children are situated here as well as the Mary Fisher Home for the Aged. It is a residential town, forming a suburb of New York, and there are manufactured by factories. Pop. 8,800.

TENAINO, té-nér'ō. See SHAHAPTIAN INDIANS.

TENANCY, a beneficial interest in some form of real property, or the relation of the lessee of land to the lessor of the same. This relation may be established without that the lessee be the holder in fee simple of the reality in question. At the present time the status of a tenant is usually created by a form of conveyance known as a lease; this is now required to be in writing in most jurisdictions. It usually contains conditions or stipulations respecting the use to which the reality may be put, the rent or compensation to be paid the lessor, the making of repairs, etc. The law also regulates the relations of the tenant to his landlord in some important respects. Thus the tenant is protected against eviction by the landlord. The tenancy may be sub-leased unless there is a restriction in this regard in the lease. A surrender or breach of the lease terminates a tenancy. See LANDLORD AND TENANT.

TENANT. See RENT, LAW OF.

TENANT-RIGHT, in British law, a right possessed by the tenant, at the expiration of his tenancy, for reimbursement for improvements, and often of considerate monetary value. It is largely governed in England by statute. Tenant-right prevailed in some parts of Ireland by custom for many years, and was formally incorporated into the law by an act passed in 1870. It is also applied to the preference given to old tenants over strangers in leases from the Church, the Crown or corporations.

TENASSERIM, té-ná'sér-im, India, a maritime division of Burmah, stretching in a north-northeastern direction between the Irrawaddy and the Malay Peninsula, between Siam and the Bay of 36,086 square miles. It is for the most part a mountainous wilderness. Within the region are the Mergui Archipelago, the chief town of the north and Taluvar area, the chief of which is the Burmese Buddhists. The mountains are rich in minerals, chiefly Burmese Buddhists, 1,400,000.

TENCH, a small cyprianid fish (7 garê), familiar in European fresh waters, especially slow-running and muddy rivers. Its color is a greenish olive, tinted with blue; the average length about 12 inches. Flesh is soft and rather insipid.

TENDA PASS, or COL I, Italy, a pass of the Maritime Alps, Italy, a pass of the Maritime Alps, the province of Cuneo, between the towns of Limone, on the carriage road and Sommet Cuneo. Its highest point is 6,195 sea-level.

TENDER, in law, a formal offer of a tenancy in a tenancy, or of an agent, or of a tenancy in common actually produced. Making a tender is the effect of freeing the defender from frequent expenses if the tender is accepted. A tender made to one of several joint owners is held as made to all. A legal tender of money of the country, originally limited to coin, but extended to authorized instruments. A payment in foreign notes or dollars, or a large sum in bronze or not a legal tender.

TENDON, or SINN, a band fibrous tissues by which a muscle is connected to a bone or other hard part. Tendons are composed of elastic strands or layers, more or less elongated, very much flattened and membranous, called aponeuroses or tendons. They glide smoothly in sheaths, especially in extensor movements; in some cases many are in a single sheath, in other situations kept in place by an annular ligament, the bead, and the blow. The Achilles tendon is a tendon of the most beautiful contrivances in the body, the manner in which the flexors or tendons in the fingers stop middle phalanx and divide to allow the deep flexors to pass through the extensor tendons to the phalanx, thus securing counteraction of shape, with freedom and motion. Contractions of tendons are benefited by subcutaneous tenotomy, (q.v.) and is also benefited by the division of the tendons of the sternomastoid muscles. Tendons of tendons, or the cause of an affection usually due to strain or sprain. Rest and mild counter irritation are the principal elements in the treatment of a strain of a tendon, less than a strain. When a tendon is cut nature makes an effort to grow or depositing new tissue in tendons. See TENDONS.

TENDRAC. See TANRE.

TENEBRAE, in the Roman Church the term used to signify the Thursday and Friday of Holy We
TENEDOS—TENEMENT HOUSE

TENEDOS, tên-đōs, Asia Minor, an island in the Aegean Sea, off the Troas Coast, near Turkey. It lies at the entrance to Dardanelles, hence has figured in naval strategy on several occasions. It is six miles three miles wide, is of volcanic formation, rugged surface, but highly fertile, cultivated for its wine. Pop. 5,000.

TENEMENT HOUSE, a multiple dwelling for the occupation of several families, each of which can live independently of the cooking within its apartment. The definition varies somewhat in different localities. In New York, Philadelphia, Washington, and other cities, it is such a house as two families. In Chicago, Boston, and other large cities, the line is drawn at more than four families. Tenement house is a generic term for what are popularly called apartment houses and flat houses or flats, as well as tenements. The attempt has sometimes been made to distinguish between apartment houses and tenements, but the two are so closely related that it is difficult to draw a clear line. Tenement houses are usually built in blocks, with a central alley, and are usually five or six stories high. They are usually built of brick, and are usually six to twelve families in each building. The first story is usually a storefront, and the upper stories are tenements. The tenements are usually divided into apartments, each of which is rented to a family. The apartments are usually small, and are usually furnished with a bed, a table, and a few chairs. The kitchens are usually small, and are usually shared by several families. The plumbing is usually poor, and the sanitary facilities are usually inadequate. The windows are usually small, and the light is usually inadequate. The ventilation is usually poor, and the air is usually polluted. The walls are usually thin, and the noise is usually excessive. The stairs are usually narrow, and the distance between them is usually inadequate. The stairs are usually narrow, and the distance between them is usually inadequate. The stairs are usually narrow, and the distance between them is usually inadequate. The stairs are usually narrow, and the distance between them is usually inadequate. The stairs are usually narrow, and the distance between them is usually inadequate. The stairs are usually narrow, and the distance between them is usually inadequate.

History.—The movement for tenement-house reform in the United States naturally began in New York, its largest city, where the need for regulation first became apparent, and may be said to date from 1842, when Dr. John H. Griscom, the city inspector of the board of health, called attention to tenement conditions in a special report on the sanitation of the city. It has since extended to almost all large cities in which tenement houses have been erected, and has taken the form sometimes of State law, as in New York and Massachusetts, or more often of city ordinance, as in Chicago and Philadelphia. The legislation in New York is the result of the investigations and recommendations of the committee of the New York State legislature, with the scope of inquiry of the New York State commission, which is typical, has been to make a careful examination into the tenement houses in cities of the first class; their condition as to the construction, healthfulness, safety, and conditions existing in tenement houses; and to report the condition of tenement houses and all phases of the so-called tenement-house question in those cities that can affect the public welfare.

Fire Protection.—Protection against fire is almost universal. Structural provisions directed to this end are contained in the building laws of all cities. In New York, Philadelphia, San Francisco, Jersey City, Providence, Syracuse and Nashville, all tenements must have fire escapes. All tenements over two stories in height must have fire escapes in Saint Louis, Baltimore, Louisville, Minneapolis, Saint Paul, Denver, Toledo and Columbus. In Chicago, Cleveland and Cincinnati, there must be a rule of one entrance to tenements over three stories in height. In many cities tenements must be fire-proof throughout when over a certain height. In Philadelphia this is true of all tenement houses; in Washington, of those over five stories; in New York, Buffalo, Louisville, Minneapolis and Denver of those over six stories in height. In Boston the limit is 65 feet.

Light and Ventilation are protected by minimum open spaces and by a limitation of the percentage of a lot which can be occupied by a building. In Philadelphia there must be open spaces at the side or rear, equal to one-fifth of the lot area, and the minimum width of all spaces must be eight feet. In Buffalo, under the local law in force before the general State act of 1901 was passed, the minimum width of any outer court was six feet in two-story buildings, eight feet in three- and four-story buildings and one additional foot in width for each additional story. The minimum interior court was 8 by 10. In Boston, a clear opening at the rear must be left equal to one-half the

Great Britain this movement has been to all kinds of houses, including tenement houses, and is usually called by the title of "Housing Reform." The initiation of the movement has been benevolent impulses, but the strong forces behind it which have given impulse to that initiative and have united to carry the movement forward have been the same which have evolved sanitary and building regulations and are founded quite as much on self-interest as altruism.

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width of the street on which the tenement fronts and there must be two open spaces at least 10 feet wide. In some cities the required court area is expressed in square feet, without reference to minimum width or length, and increases proportionately with the height of the building. This principle is adopted in New York, where the minimum width of exterior courts in buildings five stories high is 6 feet on the lot line and 12 feet between wings and the minimum area of interior courts on the lot line in buildings of the same height is 12 by 24. These dimensions are increased or decreased according as the building is higher or lower. Tenement houses in New York must have an open yard at least 12 feet wide in the rear. The maximum percentage of lot area which may be occupied by the building differs, properly, according as the lot is an interior one or a corner lot. As respects interior lots, this limitation in New York is 50 per cent; in Boston 65 per cent; in Philadelphia 80 per cent. The height of rooms is almost universally regulated, the minimum usually being eight feet. The height of tenements is limited in many cities. In New York it is limited to one and one-half times the width of the street on which it faces.

Water Supply.—In New York water must be furnished on each floor. In Philadelphia and Buffalo, on each floor, for each set of rooms. In Boston, Chicago, Jersey City and Kansas City, in one or more places in the house or yard. Water-closet accommodation is very generally prescribed. In Philadelphia and in New York, under the law of 1901, there must be one for every apartment. Under the previous law in New York, there must be one for every two families. In other cities the unit is the number of persons. It is 20 persons in Boston, Baltimore and Denver; 10 persons in Rochester.

Law Enforcement.—The enforcement of Tenement-House Law in American cities is usually vested in existing city departments to which it is most germane. These provisions, which relate to the construction of new buildings, are not in themselves enforced by a building department or by whatever part of a city government has charge of the enforcement of building regulations. Sanitary regulations are, for a like reason, usually enforced by a board of health or by whatever city officer supervises the enforcement of health laws in general. In the city of New York previous to 1901 the enforcement of such regulations was divided between the building department, the health department, the fire department and the board of health. Under such divided responsibility many of them were not enforced at all, and the enforcement of others was extremely lax. Moreover, the tenement-house problem in New York was an exceptionally large one. Of its population at that time of nearly 3,500,000, nearly 2,500,000, or more than two-thirds, lived in tenement houses as legally defined. Under these circumstances the State commission of 1900 recommended the establishment of a separate tenement department in the city of New York. This department was established under the new charter of the city which went into operation in 1902 and centres in itself all the municipal duties toward tenement houses and their such, which were previously divided among other city departments.

Model Tenements.—The erection of tenements, sound and beautiful, is primarily philanthropic, has been frequent in the United States than in Britain. The best known and earliest "Home Buildings" and "Tower Buildings" were erected by Alfred T. White, on the first named in 1879. Tower Buildings, which have been financially successful from the start, was an epoch in tenement reform. It led indirectly to the Tenement-House Law of 1879. Among successful model tenements are the City and Suburban Homes Company of New York. In the United States 610 cities are an active interest in housing, and in housing enterprises have been launched.

Great Britain's great movement towards reform in Great Britain has led to what different direction from its counterpart. The evils there have largely slum conditions than those from tall buildings and unventilated lighted rooms. The problem of tenement practically exist only in London and Glasgow. Consequently English and French effort has been directed mainly to the removal of unsanitary areas and the erection of new buildings. The city governments themselves, movements, at first local, and authorized local acts, such as the Glasgow Improvement Act of 1866 and the Liverpool Sanitary Improvement Act of 1868, have been made by the city governments themselves. The Housing of the Working Classes Act 1890 and many slum areas have been and municipal tenements built in these notably in the cities of London, Chester, Liverpool and Edinburgh.

House Regulation in Great Britain is essentially the same general subjects and follows the same general lines as American regulation. Limitations as to height are general and more drastic in America. Such houses are limited to 40 feet, and may not exceed the distance between the front wall of the building and the side of the street in streets less than 30 feet wide. In Edinburgh they are limited to 40 feet, and one-quarter times the width of the street. In Liverpool and Glasgow to the actual width of the street; in Manchester to two-stories of less than 30 feet in width, three stories in wider streets up to 36 feet. Tenement regulations on the tenant usually form part of the granting regulations. The regulations for Berlin are very elaborate, but proceed on the same general lines as in English American cities. In Berlin, houses fronting on the street may only be as high as 1 4 times the street. In Paris somewhat similar plans are in operation.

No American city has imitated the example of building municipal tenements, and has such active house department as is seen in Berlin. Serious objections to any such sphere of municipal activity would discourage and restrict.
prise, which has proved sufficient: demand. The problem is too large for a man to deal with it successfully. Use of any amount of public funds would not at its disposal. In any case, the only way to prevent private would only increase the evil which: remedied.

De Forest and Veiller. 'The House Problem' (1903); Goulding of the Working People' (1895); 'The Other Half Lives' (1890); 'At the Slum' (1899); 'First Men in Tenement House Letter' (1904); Veiller, Lawrence, 'Moral House Law' (1910); George, Will; 'Laws of Apartments, Flats and

(Richmond 1908); Dinwiddie, E. 'Living Conditions in Philadelphia'; B.; 'The Law Relating to Tenement Housing' (1899); Wall St. Cotton, and Hat Pats' (Philadelphia 1917); Part, 'Housing Conditions in Savannah 7'); Poole, Ernest, 'The Plague in Sold' (New York 1903); Chicago 30 as a Philosopher. 'Housing, Literature in Chicago Libraries' (912); 'Housing Problems in American Studies of the Seventh National on Housing, Boston, 25, 26 and 27; 'Proceedings of the National Housing Congress' (Paris 1900 et seq.); Price, 'Tenement House Inspector' (New

TENNESSEE, tén-né-sé ('The Volunteer State'), a southern-central State of the United States. Kentucky and Virginia lie to the north; North Carolina to the east; Georgia, Alabama and Mississippi to the south; and Arkansas and Missouri to the west. Its length on the northern side is 436 miles; that on the southern side is 100 miles less. The area is approximately 42,050 square miles, of which something like 300 miles are covered by the water of streams. The southern boundary of Tennessee was intended to follow the 35th parallel, but all parts of it lie from a fraction of a mile to a mile south of that line, excepting the 45 miles east of Tennessee River, between Alabama and Tennessee. That part of the northern boundary between Tennessee and Mississippi Rivers is on the parallel of 36° 30'. Immediately east of Tennessee River, the northern boundary is 12% miles north of parallel 36° 30'. Eastward from this point the boundary is not straight but on the whole approaches that line, coming within approximately five miles of it, in the middle of Claiborne County. Here there is a jog of about a mile to the north. There is a similar but somewhat greater one in
the eastern part of Sullivan County. It was the intention to make the crest of the Great Smoky or Unaka Mountains the eastern boundary between Tennessee and North Carolina. The range extends into Johnson County, and is approximately 81° 41' 4½" W. longitude. The western boundary is the middle of the Mississippi River as the channel ran in 1763, at the time of a treaty between the British and French. The most western point is in Shelby County, and is approximately 90° 28' W. longitude.

Surface Features.—Tennessee has eight well-defined natural divisions: (1) On its eastern borders rises in great ridge-like masses and treeless domes the main axis of the Appalachian chain, the loftiest peaks of which reach an elevation of 6,600 feet above the sea. Many beautiful valleys and coves nestle amid this grand range of mountains, which is known as the Unaka or Smoky Mountains, and which has an area, approximately, of 2,000 square miles. (2) Adjoining these mountains on the west is the second natural division, called the Valley of East Tennessee, which lies between the mountains and the Cumberland Mountains on the northwest. This valley has a fluted bottom, made up of a succession of minor ridges and valleys with a northeast-southwest trend. Viewed from the mountains on either side, these minor ridges and valleys melt into a common plain. This valley has an area of 9,200 square miles and is of great agricultural value. It is the southwestward extension of Shenandoah Valley of Virginia. (3) Next in order, going westward, is the Cumberland Plateau, which rises 2,000 feet and more above the sea, and 1,000 feet above the last-mentioned division. It forms a bold escarpment, on its eastern edge presenting a gray, rocky, formidable rampart. Its western edge is irregular and jagged, notched and scalloped by re-entrant coves and valleys which are separated by finger-like spurs, pointing for the most part in a northwesterly direction. Most of the northern part of the plateau is cut by deep, narrow ravines, between which are sharp-topped ridges. The southern half is divided lengthwise into two parts by the deep-cut Sequatchie Valley. The area of this division is 5,100 square miles. (4) Resting against the western edge of the Cumberland tableland and including the elevations bordering the Tennessee River in its return across the State are the Highlands, or Rimlands, having an average elevation of 900 feet above the sea. For the most part this division is a flat plain fruited by numerous ravines traversed by streams. Its area is 9,300 square miles and it surrounds, in an irregular circle, the next division. (5) Surrounded by these Highlands lies the Central Basin, elliptical in shape, with an area of 5,450 square miles. It is the agricultural region in the State, and is on an average of 300 feet lower than the Highlands that border it. (6) The valley of the Tennessee River comes next on the west. Its surface is broken and irregular. It stretches from south to north on both sides of Tennessee River. It has an average width of 12 miles and an elevation of 350 feet. Its area is approximately 1,300 square miles. (7) The slope of West Tennessee constitutes the seventh natural division and differs from all the other divisions mentioned in having but few hard occurring in a narrow belt north and bordering the Tennessee River, that with the except slope gradually toward the the most part, the surface is gravelly in places is furrowed with lowing streams that flow in slugs the Mississippi. Its area is 8,280 with an average elevation of abruptly terminates in a line of bluffs looks the great alluvial plain or b of the Mississippi River, next to be (8) The Mississippi Bottoms is eight and last of the natural divisions. It is a low, flat plain, studded and originally clothed with dark forest of its area lies below the high v Mississippi, and as a result there swamps and marshes. The area of is 950 square miles, and its ele sea is 300 feet.

A very singular topographic feature is referred to as Sequatchie Valley, a deep trough extending from a point on the south boundary of the Southern tableland into two unequal arms, the being known as Walden's Ridge. has its head near the middle between and southern boundaries of is about 60 miles long and from miles wide. It is enclosed by approximately 1,000 feet high, and centre flows the beautiful Sequatchie. The highest point in the State is Mount Guyot, which is near the Cocke and Sevier counties, and which 6,636 feet above sea-level. Other exceed 6,000 feet are Mount Henry Mountain, Clingmans Dome, High Knob, Le Conte, Mount Curtis, Mount & Master Knob. They all, with few are on or near the line that separates from North Carolina. There are a few near the eastern border of the Plateau which rise above 3,000 feet.

The Alleghany range of Pennsylvania Virginia becomes the Cumberland Tennessee, and Sand Mountain in the Blue Ridge of Pennsylvania. Virginia North Carolina takes the name of Smoky Mountains in Tennessee. long, straight valleys of Tennessee lying between the and overlooked by them are rich, beautiful — centres of industry, into a diversified system of agriculture. State altogether it will be seen that raphy is greatly diversified. The on the east are offset by the fact that the Missippisppi on the west are three great plateaus and two fruitful valleys, all differing in soils, climate and products. It is State of the greatest variety in number of 20 miles wide next to 25, 1 and the Cumberland form the principal basins of the State. The Yellowstone is tributaries of which in turn flows into the Missouri all the streams which drain the except a few insignificant ones

mall area next to the Georgia line, way through the Mississippi into the exotico. Of all the streams in the Tennessee river system, this section, i.e., from Carthage, Tenn., to Burnside, Ky., has good steamboat passenger service for six months of winter and spring. On this navigable stretch may be seen the old Indian town site and the old burial cairns at the mouth of Caney Fork, rugged Sand Shoals, Seven Sisters (a stretch of seven towering cliffs in Clay County, Tenn.), the Natural Bridge near Burksville, Ky., the historic battlefield of Fishing Creek, where the Confederate General, Zollicoffer, lost his life. It is a quaint river. Nearly every one of its beautiful scenic reaches has its legendary story. This portion of the navigable river above Carthage reaches that interesting mountain and highland section, the home of the moonshiners. It is like stepping back into the language, thought and customs of the 18th century.

The Cumberland is navigable from Burksville, Pulaski County, Ky., to its mouth, a distance of 518 miles, for about six months in the year, for boats of three feet draft, and for gasoline boats drawing one foot. From Lock 21 to Burnside, Ky., a distance of about 20 miles, it is navigable the year round. In 1908 the Federal government completed a series of seven locks and dams which rendered the river navigable for the entire year from Nash-ville, Tenn., to Carthage, Tenn., a distance of 120 miles, and since 1914 has locked and dammed the entire stretch from Nashville to the mouth of the river, a distance of 193 miles. The traffic on Cumberland River for year 1914 was 467,486 tons, value, $9,023,206. This consisted principally of corn, wheat, livestock, general merchandise, lumber, logs, sand and gravel.

The Mississippi River supplies approximately to the State 200 miles of navigation. The Holston, French Broad, Clinch, Elk and Duck rivers, all tributaries of the Tennessee, are floatable in high tide for logs and flatboats for many miles, though rarely navigable for steamboats. Obey's River, and Caney Fork, tributaries of the Cumberland, and the Ohio, Forked Deer, the Hatchie, tributaries of the Mississippi River, are navigable for 20 miles or more at high tides. Tennessee has approximately 1,200 miles of navigable waters. See also Water Power Resources of Tennessee in this article.

Geology.—Contrary to the popular opinion, all the rocks of Tennessee that show at the surface are of sedimentary origin, excepting some in three small areas near the North Carolina line, in the northeastern part of the State, which are of igneous origin. Being of sedimentary origin, they are in layers or beds, and consist of sandstones, conglomerates or pudding stones, limestones, shales, silt and clay bands. In the Smoky Mountains and the valley of East Tennessee, these beds by the slow but enormous pressure that has been brought to bear upon them from the southeast have had their original horizontal position replaced by great folds that extend in a northeast-southwest direction. Though this pressure was slow, at times and in places it was exerted so fast that the rock beds could not adjust themselves to it by bending, but instead snapped along lines parallel with the folds, thus producing on the southeast side, little by little, to be shoved.
up on those of the opposite side. Thus layers that originally were hundreds or in places even thousands of feet apart vertically now rest with their broken edges in contact with each other. Such displacements are known as faults, and there are many of them in the Great Valley of East Tennessee scores of miles long. Indeed some of them run the whole length of the valley, and into the other States at either end. It is this folding and faulting that gives direction to the Great Smoky Mountains themselves, to the valley of East Tennessee and the ridges and minor valleys within it, and to the escarpment of Cumberland Plateau.

The general lay of the rock beds beneath the Cumberland Plateau is that of a syncline or trough, with gradually sloping sides, but this simplicity of structure is broken in the south half by a pronounced arched or anticlinial structure. It is along this arch that Sequatchie River has carved out the valley of the same name.

The general lay of the rocks beneath and bordering the Tennessee Valley is that of an elliptical flat dome with its highest part in the centre of Rutherford County. The direction of the major axis of this dome is northwest-southeast, or roughly parallel with the folds of East Tennessee. This is the direction of Cumberland Plateau. The sides do not slope uniformly, but are billyow. This dome is the counterpart of a similar one in Kentucky and adjoining territory in southwestern Ohio and southeastern Indiana. In the southeastern corner of Stewart County there is a small structural dome upon which a depression, known as Wells Creek Basin, some two miles wide, has been excavated by the same natural processes that formed the Central Basin. The rock layers on the sides of this dome stand at a much higher angle than those beneath the Central Basin, of which it otherwise is a miniature duplication. The lay of the hard rock beds in West Tennessee, which are far beneath the surface, is not known, but they probably dip at a low angle to the west, as do the unhardened beds of sand and clay, above them.

The oldest rocks of the State are of Archearing Age, and occupy three small areas along the border in Johnson, Carter and Union counties. They include several formations, and consist, for the most part, of quartz, schist and granite. The remainder of the Great Smoky Mountains is composed of rocks of Cambrian Age of which there are several formations. They consist of sandstones, quartzites, conglomerates, limestones, shales and slates. Without the disturbance that has affected the region, these rocks would be overlain in the valley of East Tennessee by the younger Ordovician ones, but the folding, faulting and denudation the area has suffered has in places brought these to the surface in long, narrow belts and smaller irregular patches. Of the Ordovician formations in East Tennessee there are several, the oldest being the upper part of the Knox dolomite, a formation that in places exceeds 3,000 feet in thickness. Above it comes the Sandstone Age, like the Cambrian rocks, and for the same reason, those of Ordovician Age in the valley of East Tennessee lie for the most part in narrow, northwest belts. Because of the Sequatchie arching and the denudation upon it, rocks of Ordovician Age are exposed in the floor of the valley as they are in that of the Central Basin, and for the same reasons. The East Tennessee are limestone, marble, shale, while those in the Central Basin include 12 formations, are nearly all sandstone. The Knox dolomite nowhere attains surface in the Central Basin, but owing to a long uplift and probably to reduction in the of the overlying formations, it does occur in the Wells Creek Basin. Limestone of Silurian occurs in narrow belts in the valley of Tennessee, along the eastern escarpment of Cumberland Plateau, on the western, the Central Basin, along the streams through the western part of the Highland and along Tennessee River. Black shales of Devonian Age, known as the Chattanooga, overlies the Silurian limestone of the same distribution, except that it occurs in the northern, eastern and southern border of Central Basin. The rocks of theassic and the top of the oldest plateau are of Mississippian Age and consist of chert, shale and limestone. Those of the upper part of the Cumberland Plateau are Pennsylvanian Age and are composed of sandstone, conglomerate and coal beds.

West of the Tennessee, most of the formations are unconsolidated sand and clay. The lowest and oldest is of Cretaceous. Of these there are four formations, which crop in north-south belts, within 30 miles of the Tennessee. Westward from the Central Basin, the surface formations are of Eocene Age, with the exception of the loess on the alluvium bordering the streams. The loess, which covers a belt of 30 mile wide at the Mississippian bluffs, is of Pleistocene age; the latter is Recent. The thickness of the deposits and Eocene beds is not known, well reported to be 2,000 feet deep on the ceilings at Red River. The geological history of Tennessee that of all other land areas, is one of changed conditions. At times the place was land. At other times it was sea. At still others it was both land and sea. During the Cambrian times, the area was probably all land excepting the part covered by the sea. During the Ordovician times, the sea covered the entire area of the state. During the Devonian and Silurian times, there were many changes that brought more or less of the sea, now above the sea, now on the land. During the Triassic and Jurassic seas, the area was probably all land excepting the part covered by the sea. During the Cretaceous times, the area was probably all land excepting the part covered by the sea. During the Tertiary and Quaternary seas, the area was probably all land excepting the part covered by the sea. Since Eocene times, none of the state was submerged, excepting possibly the west for only a part of the time. Mineral Resources.—Tennessee
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On some of the high ridges are found balsam and spruce and at lower elevations black, red and post oak. The slope type consists largely of chestnut, oak, white, black, post oak and hickory. There is also to be found some loblolly pine, sour wood and black gum. The cove type represents the heaviest growth and greatest variety. Topography and soil both favoring. Here is found yellow poplar, basswood, magnolias and black walnut. In addition chestnut, white oak, beech, sugar maple, hemlock, red oak and hickory, together with a sprinkling of black birch, bittersweet, locust, ash, buckeye, sour wood, elm, cherry, sassafras and sycamore. Certain coves contain many of the above species and others few. Forest fires prior to 1907 were very destructive but are not to be compared to those of the Northwest. The necessary brevity of this article leaves much of interest unsaid.

Game.—In the early days Middle Tennessee was termed by the Indians the "Happy Hunting Grounds." Until some years after the war the whole State was blessed with an abundance of game of many species, deer, bear, wild turkey, grouse and quail. Among the migratory birds, ducks, geese, snipe and wood pigeons were found in great numbers during the winter and spring months. By the year 1900, however, conditions had been so changed through the activities of market hunters, "game hogs" and game dealers that it was difficult to find game sufficient to afford any sport. This fact impressed upon conservationists the necessity of some law to prevent extermination. The first general Game Law (chap. 169, Acts 1903) met with violent opposition in the general assembly and passed by a narrow margin. The act to protect non-game birds (chap. 118, Acts 1903) was also passed at this session. The benefits of the Game Law, however, were speedily made so manifest that by 1905 the legislature created the Department of Game, Fish and Forestry (chap. 455, Acts 1905) and added to the law of 1903 many important features (chap. 515, Acts 1905). By 1907 game had greatly increased. A close season on deer was established and several hundred deer in a private park near Nashville were purchased and freed. They soon scattered and under protection have greatly increased. Public sentiment now secured the passage of the first general Fish Law (chap. 451, Acts 1907) and Forestry Law (chap. 397, Acts 1907). Both of these measures had been "side-tracked" in the preceding legislature. In 1909 an attempt was made to legislate the State warden out of office. The Supreme Court declared the measure unconstitutional (14 Cates, 45). In 1915 another like effort was made and again the Supreme Court sustained the incumbent of the office (Howser v. Fulton). Tennessee is cursed with factional politics. Redfoot Lake, now the property of the State, can be made one of the finest game and fish preserves in the country. It has long been an El Dorado for hunters and fishermen. Public sentiment now strongly favors game and fish laws. It is necessary for their enforcement. Without this public sentiment back of it, the law is typically a "dead letter." With the establishment and operation of the game farm, the outlook for game in Tennessee is encouraging.

Fish.—Few States in the Union have as numerous streams so well adapted for fish as
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Tennessee. Many flowing into the rivers are fed by cold springs and are unexcelled for bass, trout, land-locked salmon and perch. Prior to the movement in 1903 for the protection of game and fish, little attention was given this valuable asset. Seining was frequent and discriminating not uncommon. Little attention was ever paid to local laws. It was not until 1907 that the general Fish Law was passed (chap. 469, Acts 1907). This law was sought to be amended in 1915 (chap. 152, Acts 1915) and the State Warden also removed from office. The Supreme Court held this could not be done, but did not pass upon the other features of the bill.

It has been a hard struggle to protect fish in Tennessee. The people have not been educated to the need of their protection. The fine waters, and particularly Reelfoot Lake, should supply fish food in greatest abundance at reasonable costs and out of season, like the English sparrow, has been a great misfortune. Eradication of either seems impossible. There has also been a decrease of fish from the pollution of streams. This is a common act, but most uncivilized practice. The agencies at work are known to be inadequate. The development of manufacturing industries with no restrictions upon disposal of waste is fast ruining many fine streams and the fish have become unattainable from the tainted of the water. The mountain streams of the eastern division, where the population is not sufficient to cause damage by sewage, are often affected by sawdust. Seining, dynamiting and pollution are combining to destroy the fish of the State. Drastic measures must be adopted. It is feasible to keep wastes out of the waters and it is possible to turn them into profit through valuable by-products. A campaign of education as well as law is essential to accomplish the needed results.

Soils.—The soils of the Great Smoky Mountains are mostly rich clays and loams. Those of the valley of East Tennessee are mainly red to brown clay and loam that are very productive, though there are narrow belts disturbed by extreme alterations that are porous. Those of the Cumberland Plateau are in parts sandy and in others clayey. The former are not productive and should never be cleared; the latter are not strong, but are susceptible of great improvement. Those of the Highland Rim are in parts fairly good, in others poor, but all can be improved and brought to a high state of cultivation. Those of the Central Basin are very productive clays and loams, and most of the area is in a high state of cultivation. The soils of the western slope vary from those that are sandy and of little worth, through loams and clays that are fairly good and susceptible of great improvement to the rich loess area near the Mississippi, and the rich though narrow alluvial bottoms of the Mississippi, Tennessee and smaller streams.

Agriculture.—The area of Tennessee is 42,022 square miles, or 26,912,000 acres of which 21,000,000 are farm lands and more than one-half of this area is improved. The principal crops and stock are corn, rice, wheat, and cotton, leading in importance in the order named. Clover, timothy, soy beans, cow-herd's grass, lespedeza, vetch and alfalfa grown for hay.

The production of strawberries and totoes has become one of the spring feasts especially in Gibson and adjoining counties. From these and other points vast quantities of vegetables and fruits are shipped to the New York markets. The entire State offers ideal conditions necessary to successful fruit culture. Stock raising is an important industry. Hogs are an important product. Poultry raising is extensive, and dairying is generally followed near the larger cities and towns.

Stock raising in all its branches is generally followed, but this industry is far short of possibilities. Some advantages the stock raises enjoys in this State are an agreeable climate, a high price for products, and a market in which the demand is always in excess of supply. In short, as a stock-raising center Tennessee has no superior and but few equals among the States of this Union. The grass section of the State has bred some of the finest roofing and the finest harness in the world.

Agricultural Department.—The office of the commissioner of agriculture of Tennessee was established in 1871. It was then housed in the old state capitol. The present building was completed in 1874 and is the Federal office building.

The Agricultural Department has been steadily increasing in importance and has become of supreme importance to the State view of the fact that a population of 2,000,000, 80 per cent are farmers and planters more than ever before have become interested in scientific farming and farming not as a means of livelihood but as a proper business.

The soils of Tennessee are well adapted to diversified farming and respond bountifully to modern methods. In fact, as an all-round agricultural state, Tennessee is unequaled in any other region in the United States in the variety, profusion, character and quality of its farm products. Wonderful possibilities exist in the soils, climate, physical structure and drainage of the agricultural areas, and frequent demonstrations of great crops are reported to the Agricultural Department from the three grand divisions of the State, as the result of applications for crops and results, sometimes on the richest and most modest of intensive methods applied in the preparation of the land and the cultivation of the crops, exemplifying the versatility and capacity of such lands and the progress of their development.

There are three assistant commissioners of agriculture, who hold office by appointment of the commissioner, and whose work is in his direction. The appropriations by the General Assembly for the salaries and expenses of the various offices under the commissioner's direction for the fiscal year 1918 approximate $35,000.

Scientific farming is making rapid strides in Tennessee, and the State's splendid citizens have become fully awakened to the truth that "co-operation is essential to success." The
TENNESSEE

...nstrated at the farmers' institutes, meeting held annually in each three grand divisions of the State—Tennessee in May, West Tennessee in Sep-

... the sense

...ion; they are discarding the old and adopting the new. In their homes establishing new conditions, making

...es not merely of shelter but of com-

...ury. The tractor and the auto-

...e rapidly displacing the old-time im-

... and the buggy. The annual value of

...ducts approximates $150,000,000; value

...tie animals, $107,000,000; value of all

...erty, $614,000,000. It is worthy of

...very crop scheduled in the Federal

...en grown to some extent in Tennessee. 

...ries,—Although Tennessee has always

...is still, essentially an agricultural state, the value of $259,990 per

...value strongly indicates marked pre-emi-

...ntries in the years to come. This

...ence would seem to be a necessary

...to the development of its great natural

...; and it is to be noted that its present

...on is along these lines. Approximately

...0 is the capital invested in Tennessee

...ring generally.

...ing to the census of 1909 the total

...of the State of Tennessee)

...; and of these 1,917 were represented

...ishments making lumber and timber

...If to these be added the industries these products, such as car and car-

...ories, approximately one-half of the

...uring establishments of this State de-

...in the natural resources of timber.

...ence naturally is that Tennessee is a

...ded State, and such is the fact. Of the

...of 26,000,000 acres in Tennessee, approx-

...5,000,000 acres woodland. Three

...ach more than 200,000 acres of virgin

...and while much of the wooded area

...ate is second and third growth, there

...quantity of virgin timber in inaccessible areas; so much as doubtless

...material for the manufacture of

...nd wood products for many years to

...ennessee has $16,000,000 capital in-

...; the timber business and 1,500,000

... it are cut yearly.

...e of products, the flour-mill and grist-

...try stands but little below that of

...and timber products. The soil and

...itions of wheat and corn; but this in-

...ses not depend upon local supplies of

...rial; for much wheat and corn are

...into Tennessee mills from the West

...Northwest, and the milling in transit

...erried for many years by Nashville.

...ville's largest milling center, has tended

...ate this industry and place it upon a

... and stable basis.

...manufacturing industries of Ten-

...the industries are found in

...machine-shop products; printing and

...; cars and general shop construction

...rs by steam railroad companies; oil,

...d and coke; iron and steel blast fur-

...naces; textiles, and a very large list of other

...industries aggregating 4,775 establishments in

...1914 and covering almost all articles manufac-

...ured to meet the ordinary demands of modern life.

...The summary of the manufactures of Ten-

...ee for 1914, prepared by the Bureau of

...ensus, gives the following statistics: Number

...of establishments, 4,775; persons engaged in

...manufactures, 38,514; proprietors and firm

...members, 5,142; salaried employees, 8,999;

...age-earners (average number employed dur-

...ing the year), 74,373; primary horse power,

...365,857; capital, $211,423,000; services, $44,910-

...00 (including salaries $11,828,000, wages $33,

...022,000); materials, $123,430,000; value of prod-

...ucts, $212,071,000; value added by manufac-

...ure (value of products less cost of materials),

...86,641,000.

...This summary shows a consistent increase in

...the census report of 1914 as compared with

...that of 1909. In the order of their importance,

...from a percentage point of view, the increases

...for the several items named are as follows:

...Salaries, 28.8 per cent; payments in goods,

...materials, 18.7 per cent; primary horse power,

...8.4 per cent; value of products, 17.7 per cent;

...wages, 17.1 per cent; value added by manufac-

...ure, 16.3 per cent. It must be borne in mind

...that the United States Census with reference

...to manufactures excludes hand trades, building

...trades and neighborhood industries and takes

...account only of establishments conducted under

...the factory system. Furthermore, they cover

...only establishments having annual products

...valued at more than $500. The four large cities

...of the State, Nashville, Memphis, Chattanooga

...and Knoxville, have more than one-fourth of

...he total establishments of the State. In these

...cities are most of the very large manufacturing

...enterprises, such as the following in Nashville:

...Milling, printing, car-shop construction, stoves

...ranges, fertilizer, tobacco and lumber. In

... Memphis lumber and allied wood-working

...industries, industries connected with cotton, par-

...icularly cottonseed oil mills, molasses mills.

...In Chattanooga iron and steel manufactures,

...hosiery mills, knitting mills, wood-working

...plants. In Knoxville marble enterprises, wood-

...working establishments, knitting mills.

...Speaking generally, the outlook for manufac-

...tures in Tennessee is exceedingly encour-

...aging, and it is likely that in the years to come

...this State will be a very large manufacturing

...State. This result will be brought about largely

...by two causes, cheap hydro-electric power and

...proximity to great natural resources.

...Transportation.—Growing out of the agita-

...tion for internal improvements about the

...year 1830, the State undertook with enthusiasm

...promotion of railroad development. The South

...Carolina Railroad, chartered in 1828, the

...construction of which began in 1829, doubtless fur-

...ished an impulse to the movement. The desire

...was for an outlet to some southern port for

...the products of agriculture and industry. The

...first railroad chartered in the State was the

...Memphis Railroad Company, a proposed line

...from Memphis to Pulaski, on 12 Dec. 1831.

...The line was never built. In 1836 the Hiwassee

...Railroad was chartered and completed in 1837,

...probably the first work ever done on a

...railroad in the State. This line now forms a

...part of the Southern Railway between Knox-

...ville and Chattanooga and was completed in
1856. In 1845 the Nashville and Chattanooga Railroad Company was chartered and the track between Nashville and Chattanooga was finished in 1856. This was a complete line of railroad operated in the State. In 1845 a great commercial convention was held at Memphis, over which John C. Calhoun presided, out of which grew the Memphis and Charleston Railroad, now a part of the Southern Railway.

The steam railroad mileage of the State for the fiscal year ended 30 June 1914, exclusive of switching and terminal companies, was 4,105.55, or 1.63 per cent of the total mileage of the United States. The State had 985 miles of line for each hundred square miles of territory and 18.42 miles of line for each 10,000 inhabitants. In 1870, with 1,492 miles, it ranked 12th in its proportion to the total mileage. In 1914 its standing in this respect was 29th, while as to mileage on the basis of territory it was 28th and on population 38th. Prior to the Constitutional Convention of 1870, the State gave large aid to railroad development and up to the Civil War period, had issued bonds for that purpose amounting to approximately $15,000,000.

For the calendar year 1914 the State levied taxes against 39 railroad corporations, having an assessed value of distributable and localized property of $80,782,245, upon which the tax for State purposes alone was $317,755.40. Excluding the special excise taxes of the government, the railroads in the State pay in annual taxes approximately $448 per mile of road. The six railroads in the State operating or controlling more than 50 miles of line, and which embrace about three-fourths of the total mileage, are as follows: Louisville and Nashville Railroad Company, 1,888 miles, including the Nashville, Chattanooga and Saint Louis Railway, with 989 miles; the Southern Railway Company, 945 miles, including the Mobile and Ohio Railroad Company with 119 miles, and the Virginia Southwestern Railway with 101 miles; the Illinois Central Railroad Company miles; the Tennessee Central Railroad Company, with 294 miles; the Cintra Orleans and Texas Pacific with 143 miles, and the Carolina, Chat and Ohio Railroad with 35 miles. The rates of the State are equitable and the railroads have a maximum rate of two and a half cents.

For the most part, the railroads are an unusual degree in the development resources along their lines. The street railway mileage in the State was 309.9, and had an assessed value of $14,607,308.99.

The Water-Power Resources of Tennessee

To state in definite figures the water which can and ultimately will be obtained from the rivers of Tennessee is a possibility. Any comprehensive water-power development must, for location, ignore political boundaries. For this reason it is not possible to segregate the power resources of one State from the neighboring States. Further, the quantity of power to be obtained from any given stream is wholly a question of the possible storage of water in reservoir construction of which forms an essential part of the water-power development. The evolution of reservoirs is itself complex, involving questions of vested rights, the cultural value of lands to be flooded, the location of railroads which are already established and as to the rendering of great many other attractive water-power projects impracticable. Further, other questions of a nature no less vital to the estimate of power potential in a single river.

Such figures, therefore, as may be presented are to be regarded merely as approximate estimates, and the following tables have been compiled with great care from all the available data, must be so interpreted.

**Summary of the Water Power Available for Development, Without Storage, Within Tennessee. Minimum Horse Power During the Six High-Water Months.**

<table>
<thead>
<tr>
<th>STREAM</th>
<th>LOCATION</th>
<th>HORSE POWER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tennessee River</td>
<td>Shellman to Chattanooga</td>
<td>5000</td>
</tr>
<tr>
<td>Tennessee River</td>
<td>Chattanooga to Nashville</td>
<td>3000</td>
</tr>
<tr>
<td>Hiwassee River</td>
<td>Ocoee River to Ocoee Line</td>
<td>1000</td>
</tr>
<tr>
<td>Clinch River</td>
<td>From mouth to Line</td>
<td>500</td>
</tr>
<tr>
<td>Powell River</td>
<td>From mouth to Line</td>
<td>500</td>
</tr>
<tr>
<td>Little River</td>
<td>From mouth to Line</td>
<td>500</td>
</tr>
<tr>
<td>Tellico River</td>
<td>From mouth to Line</td>
<td>500</td>
</tr>
<tr>
<td>Little Tennessee River</td>
<td>From mouth to Line</td>
<td>500</td>
</tr>
<tr>
<td>Ocoee Creek</td>
<td>From mouth to Line</td>
<td>500</td>
</tr>
<tr>
<td>Abare Creek</td>
<td>From mouth to Line</td>
<td>500</td>
</tr>
<tr>
<td>Little Pigeon River</td>
<td>From mouth to Line</td>
<td>500</td>
</tr>
<tr>
<td>North Fork of the Hiwassee</td>
<td>From mouth to Line</td>
<td>500</td>
</tr>
<tr>
<td>Roan River</td>
<td>From mouth to Line</td>
<td>500</td>
</tr>
<tr>
<td>Scott River</td>
<td>From mouth to Line</td>
<td>500</td>
</tr>
<tr>
<td>South Fork of the Hiwassee</td>
<td>From mouth to Line</td>
<td>500</td>
</tr>
<tr>
<td>Watalla River</td>
<td>From mouth to Line</td>
<td>500</td>
</tr>
<tr>
<td>Scott River and tributaries</td>
<td>From mouth to Line</td>
<td>500</td>
</tr>
<tr>
<td>Tellico River</td>
<td>From mouth to Line</td>
<td>500</td>
</tr>
<tr>
<td>Sand Fork of the Tellico</td>
<td>From mouth to Line</td>
<td>500</td>
</tr>
<tr>
<td>Small water power not recorded by United States Geological Survey</td>
<td>From mouth to Line</td>
<td>500</td>
</tr>
</tbody>
</table>

**T**otal available for two hundred of the time

*The United States Geological Survey concludes, 12,000,000 horse power of the Tennessee River from Chattanooga to Nashville, but the above statement would not permit of the development of this power. A report of the chief engineer of the United States army, 20,000 horse power, or 140,000 horse power for the entire river system, is not considered as realistic. In miles the river is 300 miles from Knoxville to Nashville.

*1. A September, 1913, the small water power of the State capable of being developed by individual enterprise is estimated to be 50,000 horse power. The writer estimates the total power of the resource of Tennessee, from the report of the Chief Engineer of the United States army, 20,000 horse power, or 140,000 horse power for the entire river system, is not considered as realistic. In miles the river is 300 miles from Knoxville to Nashville.*
TENNESSEE

The total amount of power which a company can produce, even with the cheap coal, will render available 100 per cent more than double the above estimate.

The development of the State in the future will necessarily depend on the construction of additional power plants. The Power Company has consented to supply power to Caney Fork, and to the Cumberland River. The Company's new power plant at Caney Fork, near Greenville, will furnish power to the Nashville Railway and Light Company and other railroads in the neighborhood.

The Tennessee Power Company has already completed within the State the third water-power plant, to develop power on the Tennessee River. The Company's new power plant at Caney Fork, near Greenville, will furnish power to the Nashville Railway and Light Company and other railroads in the neighborhood.

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The estimated value of property owned by the State in 1883 was $1,579,475; estimated value in 1914, $5,316,378.

Sources of Revenue.—Taxes on polls, on property, on incomes, on sales of land, on exercise of privileges, on litigations, from fines and forfeitures, from merchants, from peddlers, and from collateral inheritance tax. All taxes must be uniform.

Exemptions.—One thousand dollars, personal property of each resident taxpayer; United States, State, and municipal property not used for rental; religious, charitable, scientific, literary and educational property, subject to certain minor limitations; agricultural and mechanical associations worth less than $10,000; all public thoroughfares and parks dedicated to public use; all growing crops, direct product of the soil.

Banks and Banking.—The following figures largely exhibit the condition of banks in Tennessee in March 1910:

<table>
<thead>
<tr>
<th>National</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of banks</td>
<td>107</td>
</tr>
<tr>
<td>Capital paid in</td>
<td>$14,570,000</td>
</tr>
<tr>
<td>Surplus and undivided profits</td>
<td>$5,453,105</td>
</tr>
<tr>
<td>Actual cash</td>
<td>5,064,000</td>
</tr>
<tr>
<td>Total reserve</td>
<td>18,560,000</td>
</tr>
<tr>
<td>Deposits</td>
<td>76,033,809</td>
</tr>
<tr>
<td>Total resources</td>
<td>129,228,000</td>
</tr>
</tbody>
</table>

Tennessee has a modern banking law. The State banks are regarded with exceptional con-
TENNESSEE

fidence by the public. It is optional with the State banks to assume double liability of stockholders. The State under its constitution cannot become the owner in whole or in part of any bank.

Government.—The separation of the powers of government into legislative, executive and judicial departments was specifically recognized in 1796. The State under its constitution, also, without mentioning it, so organizes the government. Under the 1776 constitution the legislature elected the governor, who was given no veto power until 1870. Until 1853 the judges of the principal courts were elected by the legislature. Not until after 1834 were the justices of the peace elected by the people. The North Carolina and early Tennessee courts adopted with little hesitation the doctrine of judicial review of legislation. The power of the legislature has been made subject to gradually increasing limitations, both procedural and relating to the variety and scope of its enactments. In 1870 the reaction against the arbitrary acts of the reconstruction governors resulted in the decrease of the powers accorded the governor.

The constitution of Tennessee has reflected its economic and social history. The simple agricultural commonwealths of the 18th century, after securing the people against the encroachments upon their "rights" which had become so frequent under royal governors, demanded only an outline of the frame of government and a few other elementary provisions such as the regulation of the suffrage. The power of the land speculators showed itself clearly in the requirement of a specific land tax in 1796. The enthusiasm for internal improvements was apparent in the constitution of 1834; reaction against its abuse, and against prevalent careless methods of dealing with corporations, in the constitution of 1870. The relative decline of agriculture and the vast increase of mining and manufacturing interests, as well as the trend of population city-ward furnish the economic background for a new convention.

Education.—The present school system controlled by a State board of education; the denominational schools and colleges, the private preparatory schools and the several city systems constitute the means of education. Educational upbuilding has been marked since 1872, which is the time of the beginning of the three chief agencies within the State, namely: (1) The system of public schools, inaugurated by the State legislature; (2) The establishment of George Peabody College for Teachers by the Peabody Board of Trust, and (3) The founding of Vanderbilt University. The general growth of education has been from the eastern boundary of the State toward the west. Of the three grand divisions — East, Middle, West — East Tennessee has had the highest and most general development, while Middle Tennessee is second and West Tennessee the lowest.

Public Schools.—The University of Tennessee is the head of the public school system with all departments located at Knoxville, except the medical and dental colleges which are at Memphis. The department of agriculture maintains jointly with the United States Department of Agriculture and the State department of agriculture, an extension division which takes to every county experts of every kind needed for farm development. Farm demonstration agents are employed in the counties receiving this service. Support is received from the Morrill Act Fund of 1890; the Nelson Fund, Act of 1907; the Land Grant Fund, Act of 1862; the Hatch Fund, Act of 1887; the Adams Fund, Act of 1906, and from the appropriations of the State constitution. The annual expenditure is from $350,000 to $400,000. An attendance of 1,000 students is maintained beyond that of the Summer School of the South which annually registers 1,500 attendance. Control of the university is centered in a board of trustees appointed by the governor, one from each Congressional district of the State.

The State board of education has under its direction the normal schools, the high schools and elementary schools through the officers of instruction. This board is appointed by the governor and consists of nine members, with the stipulation that not more than three members shall be from any one grand division of the State. The offices filled by the State superintendent of public instruction are: State high school inspector, presidents of the normal schools, teachers of the normal schools, supervisors of elementary schools, conductors of teachers' institutes and the examiners of teachers' examination papers. Other duties of the board are: Examine teachers under a uniform State law; examine applicants for the position of county superintendent of schools; apportion the school fund as outlined by law; adopt schoolbooks, both elementary and high school; outline all courses of study; certificate all teachers, county superintendents and graduates of the elementary and high schools, and to issue such regulations as may be needed under legal provisions in the general supervision of the public school system.

The school fund is derived from county levies, which vary in amount, and are collected by the county treasurers. However, one and one-half mills on the dollar of assessed property is mandatory for all counties through a State enactment. Also, the general education fund established in 1909 provides that 33 1/3 per cent of the gross revenues of the State be expended for school purposes, same to be divided as follows: 61 per cent for elementary school; 13 per cent for county superintendents; 10 per cent for county supervisors, consolidated schools, industrial work, salaries of county superintendents; 6 per cent to county high schools; 2 per cent to the Cookeville Polytechnic Institute; 13 per cent to normal schools; 7 per cent to the State University. A poll tax of $2 supplements this fund. The aggregate fund is approximately $8,000,000 — apportioned by the State Board of Education to a school population of 780,000 with 12,000 teachers whose average salary is $50 per month for a term of 130 days. Four normal schools are maintained, one of which is for negroes — with an annual total enrollment of 2,500. Seventy-one counties out of 96 have county high schools with an enrollment of 12,500.

The Roman Catholic Church maintains 2 parochial schools, with 4,170 pupils, one college for boys with 350 students, five academies for
th 619 pupils, two orphan asylums with
ians, making a total of 5,464 young peo-
people under Catholic care out of a Catholic
on of 19,000.

The famous Webb School in Knoxville is the pioneer of college prepa-
schools in the territory southwest of the
Ohio. Others of the same type whose
purpose is to train boys for college are
Rutherford High School at Spring Hill;
School at Fayetteville; Hawkins
Gallatin; Castle Heights, Lebanon;
Ground Academy, Franklin; McTyeire
McKenzie; McFerrin School, Martin;
School; Pulaski; Peoples-Tucker
Springfield; Montgomery Bell Acad-
nashville; Duncan School, Nashville;
School, Nashville; Wallace School,
le; Baylor School, Chattanooga; Mc
School, Chattanooga; Columbia Military
Maryville; Milledgeville; M. Meade; Nes
Military Academy; Industrial School,
lon.

Institutions.—The following colleges
ngly supported and enjoying prosperous
trations: Vanderbilt University, Nashville;
George Peabody College for Teach-
eral Education Board), Nashville; City of Chattanooga (Methodist); Car
neman College, Jefferson City (Bap
villian College (Disciple), Tusculum
r, Greenville; Washington Col
resbyterian); University of Tennessee,
le (State); Cumberland University,
(Presbyterian); Southwestern Presby
University, Clarksville (Presbyterian);
University, Jackson (Baptist); Tennees
murfreesboro (Baptist); University
the South, Sewanee (Episcopal); Mary
lege, Maryville (Presbyterian); Col
the Christian Brothers, Memphis
; Sacred Heart Institute, Memphis
.

or Colleges.—Several institutions have
red regular junior college curricula as
Ward-Belmont, Nashville; Buford
ites, Columbia, 1867-68. From 1870 to
n College, Madisonville, and the State
s at Murfreesboro, Johnson City
mphis.

Institutions for Negroes.—The
standards of efficiency are attained in
red institutions which take their place
le similar schools for the white race.
iversity, Nashville (Congregational);
williams, Nashville (Baptist); Walden
ity, Nashville (Methodist); Lane Col
ckson (Methodist); College; Col
hely; Industrial Normal
nville (State); Academy and Indus
of the Immaculate Mother, Nash
:

ria.

Institute.—The following in
is receive their support from the State:
entral Hospital for Insane located near
le; the Western Hospital for Insane
Bolivar; the Eastern Hospital for
located at Bearden; the Reformatory
ys located near Natchez; the Tennessee
School located near Nashville; messeer Confederate Soldiers’ Home at
age; three of the larger counties in

Tennessee have their own industrial schools,
namely, Shelby, Knox and Hamilton.

Throughout the State are a great many
stitutions which derive their support through
ditional contributions from individuals,
through societies organized for that purpose,
such as the Masonic Home located near Nash
ville, the Odd Fellows Home at Clarksville
the Old Woman’s Home at Nashville. Many counties in the State maintain charity
stitutions such as county asylums, poor
ghouses. The State has also in the past given
aid to private institutions such as the Ten
essee Children’s Home, Finding Society
nd the School for Blind Girls.

Penal Institutions.—Penal institutions are
the penitentiary, or State prison, to which per
sons convicted of felonies are sentenced; and
county jails used for the detention of persons
 awaiting trial, or those who have been convicted
of felony and are temporarily to be con
veyed to the penitentiary. Sentences for
terms less than one year are to the county
d, and persons fined by the criminal courts
and failing to pay such fines are also im
prisoned therein. Under the law a county jail
may be declared to be a workhouse in which
the prisoners may be worked on the highways
during the term of their sentences, or
until their fines shall be paid according to a
schedule of valuation placed upon their labor.
The cities also have workhouses for the
punishment of infractions of city ordinances
authorized by State law. Workhouse prisoners
may be transferred from one county to an
other, and hence the labor of prisoners from
several counties may be applied to highways in
one county together, an arrangement due to
the fact that in most counties there are very
few county prisoners.

The penitentiary, or State prison, was es
lished under an act passed in 1822, and be
gan to receive prisoners in 1831. It was con
ducted under the direct management of the
State until 1870, except when held by the
United States military forces from 1862 to 1865,
and except when under an abortive lease in
1867. From 1870 to 1867 the lease system
was in force, although the State at the same
time employed a superintendent, wardens and
physicians, to look after the interests of the
prisoners and State, as well as could be done
under the system.

The act of 1893 provided for a change to
the State account system, with a provision
permitting the hiring out of a part of the con
victs at the main prison under contracts for
labor by the day; also for the purchase of
farm and coal lands. A farm of 1,100 acres,
lying in a large bend of the river six miles
below Nashville, was bought and a commodious
modern prison was erected thereon. Later
2,400 acres were added to this prison farm.
For coal mining purposes the State purchased
the Brushy Mountain tract of 12,000 acres in
Morgan and Anderson counties, and later pur
chased "Herbert Domain" of 10,000 acres in
Bledsoe and partly in Cumberland, White
and Van Buren counties. This latter tract is
supposed to contain good coal, but it has not been
opened. In the same act the State is forbid
ned to mine by convict labor except in the
State’s mine. A large number of convicts are
employed at Brushy Mountain, the number on 1 Dec. 1914 being 616, while those in the main prison were 1,243; total, 1,859. White convicts were 651, colored 1,208. Females 62, all at Nashville.

At the main prison two-thirds of the convicts are employed in manufacture, blacksmithing, carpentry, and domestic work, etc., under direct workgangs; the remainder are similarly employed on contracts with outside parties, but all are kept under the eye of trusted State officials to see that the humane provisions of the law are carried out.

During 1915-16 200 convicts were hired to Campbell County, and 50 to Williamson, and employed in working on public roads at 10 cents an hour. This new departure seems to be successful; there is a strong movement so to employ the mass of the convicts in the future.

The Indeterminate Sentence Law is in force.

In 1915 an act was passed creating the Board of Control, with its office at Nashville, whereby the several public institutions of the State Reformatory, the Tennessee Industrial School, asylums for the insane, deaf, dumb and blind schools, are brought under one board for their better and more uniform management. The statistics of the operations of this board have not been issued for 1915-16.

For a number of years following 1897, when the new system for the prison went into effect, profits over expenses were large, often running over $200,000 net profits a year, but in more recent years the receipts have not much exceeded expenses.

While the convicts were employed under the lease system and many of them confined in the old prison which was, from 1887 to 1897, within the city limits of Nashville, the death rate was very high, being at times over 3 per cent; the report to the end of 1914 shows a death rate of 9.3 per cent.

There are two institutions which are penal in character, the Tennessee Reformatory for Boys and the Tennessee Industrial School. The reformatory is in a different part of Davidson County from the main prison, but is in a way connected with it, and to it are committed young convicts with a view to reformation.

The Criminal Courts may send any convict under 18 years of age to this reformatory, and nearly all such are so disposed of. The population of the reformatory is 497.

The industrial school is designed for the care of young persons who are without the care of guardians or provident parents and such as are found wandering or loitering in company of evil repute. The pupils or inmates of the industrial school, number 890. Several different counties maintain institutions of the same kind, and they are recognized by the courts. The discipline is of great value, and there are many pupils who have not been placed in the school by reason of any complaint against them.

The act of 1911 establishes the Juvenile Court and divides young offenders and unfortunates into two main classes, namely, delinquent and dependent. Delinquents are those who have committed some penal offense, while dependents are such as have been mentioned herein in connection with the industrial school.

The cities are divided into districts, each having a district or juvenile court, but in nearly all the counties this position is assigned to the judge or chairman of the County Court. No person under the age of 16 years can now be tried and sentenced, in the first instance, to the penitentiary, but it being the duty of the judge of the Criminal Court whenever a person of such age is indicted to turn such youth over to the Juvenile Court. The Juvenile Court shall send him to the reformatory, industrial school, or other institution of the kind, or may commit him to the care of a guardian, for a definite period; and shall retain supervision until the youth shall be of age.

The person accused has free legal counsel, and his parents may defend him. If the youth prove totally incorrigible, after due effort at reform, he may be tried later as any other criminal and sentenced to prison. By the act of 1915 capital punishment was abolished.

**Archaeology.**

**Eolithic and palaeolithic Man.**—Where and when man first appeared on this continent, and how he came into the section now known as Tennessee is still undecided. It is claimed, and also denied, that remains of man of same geological age and culture as that of the earliest and rudest of eolithic and palaeolithic man at Europe have been found in several sections of the United States, but no well-authenticated finds of such have been made in Tennessee. If eolithic or palaeolithic man ever existed on this continent, the caverns and rock-shelters of the Cumberland and Tennessee valleys offered ideal places for their abodes. These were about the right distance below the great ice fields—which reached to the Ohio River, at or near the end of the last great ice age—offered practically the same climate and shelter in which eolithic and palaeolithic man were found in Europe.

**The Mound Builders.**—Formerly it was believed that the ancient mounds and fortifications of this section were built by a long-vanished race of people, of lighter complexion and different from the Indians. This belief originated from some of the early Indians telling the whites that the Indians did not build the mounds, but they were built by an earlier white race, which the Indians conquered and exterminated. Modern research has proved this to be untrue. It is now well established that these great earthworks were built by Indians.

The contents of these mounds, and the manner in which they were placed therein, are of the same nature as those of the ancient races among the whites. The mounds were found in connection with the mounds, for seats for their religious houses, and for the residences of their chief men. Scattered along the larger water courses of Tennessee are probably ancient mounds. Each mound is usually accompanied by a village site and hundreds of ancient graves. These remains are of various different ages and show somewhat different artifacts and customs. It is probably true that...
TENNESSEE

As many ancient Indian graves in see as there are white graves. The population of Tennessee was probably at any one time, over 20,000; but In-

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were the principal

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Cherokees. The Cherokees were a separate tribe of the Iroquois stock, and one time held the entire southern Al-

De Soto found them in this section as 

1540 and they probably had been here for 200 years before. They were a

all between Tennessee and the Cumber-

and on to the Ohio River, but had few towns in that region. The Chero-

ees and Chickasaws moved the Shawnees to the region around Nashville, about the 

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that date it has taken an active and leading part in all the wars in which the country has been engaged. In the War of 1812 she furnished 28,000 troops and had double the number that any other State in the battle of New Orleans, fought by General Jackson—one of her sons—on the 8 Jan. 1815, in which the British commander, General Packenham, was killed. In the several Indian wars east of the Mississippi in the States of Florida, Georgia, Alabama and Tennessee, furnished nearly all of the soldiers engaged, as well as the commanding officers—Jackson, Houston, Coffee and Carroll. The happy ending of these wars gave peace and security to life and property to the people of these States against the torch, tomahawk and scalping knife of the cruel, treacherous and relentless savage. The principal battles in these Indian wars were Tallahatchee, Tuscaloosa, Emucktaun, Etowah, and Oconee, on the Tallapoosa River, and the decisive battle of the Horseshoe, which ended the Creek War— their noted chief and leader, Red Eagle, being captured.

The next link in her military history is the five years of the Mexican War, from 1846 to 1848. Under the terms of the Treaty of Guadalupe Hidalgo, she was entitled to 10 regiments of foot and 3 of horse, and she furnished 5 regiments of foot and 1 of horse. In the war with Mexico she furnished 10,000 troops, and in the three years of the Mexican War, 1846, 1847 and 1848, furnished 12,000 soldiers. In the war with Mexico she furnished 10,000 troops, and in the three years of the Mexican War, 1846, 1847 and 1848, furnished 12,000 soldiers. In the war with Mexico she furnished 10,000 troops, and in the three years of the Mexican War, 1846, 1847 and 1848, furnished 12,000 soldiers.

In the War with Germany in 1917-18 the State's gross quota was 25,515; enlistment credits totaled 25,515; draftees enlisted, 11,899; the net quota, 14,525. The number of registrants under the Selective Service Law was 188,946, of whom 54,827 were called for examination. Of these 15,909 were accepted, making the ratio to those called for examination 31.02 per cent. There were 34,069 colored registrants, of whom 7,940 were called for examination and 2,666 were accepted. The aliens from Entente countries, who registered, numbered 794; 73 were from neutral states; 44 were alien enemies.

State Formation.—The State of Tennessee was formed out of the western half of North Carolina. The first white men of whom we have any account to set foot on Tennessee soil were De Soto and his band of adventurers, in 1541. In 1662 La Salle built a fort which he called Prudhomme, where Memphis now stands. Fort Loudon on the Little Tennessee River, 30 miles below Knoxville, was built and occupied by the British in 1756. In 1760 it was surrendered to the Indians, who destroyed it and destroyed the British claims to the Tennessee land. It was called The Watoga Settlement. In 1771 Parker and Carter set up a store to trade with the Indians where Rogersville now is. This was called The Carter Settlement. The next year Jacob Brown established the Cumberland Road. In a short time many settlers built cabins around these stores. Another settlement was made on the Holston River, which soon became an important centre. These pioneers, being far from the mother State, without government, and without protection, in 1772 organized themselves into the Watoga Association, the purpose of which was to protect themselves and to dispense justice among the colonists. The leaders were John Sevier and James Robertson. The Watoga Association more soldiers during our Civil War than any other Southern State, North Carolina furnishing a few thousand more to the armies of the South than she did.

She furnished active service 1 lieutenant-colonel, 9 major-generals, 33 brigadier-generals and 153 colonels, with lieutenant-colonels and majors in proportion. She had nine general officers killed in battle to wit: Zollicoffer, Hatton, Smith, Tyler, Strahl, Carter, McCloud, Adair and Kcranet. She furnished nearly all of the soldiers engaged, as well as the commanding officers—Jackson, Houston, Coffee and Carroll.

The semi-military organizations of bison and chapters had their origin in Nashville. The celebrated Ku Klux Klan (q.v.), which worked for peace and security, not only for her own people, but for the entire South, also originated in one of her towns—Pulaski—in the county of Giles.

To show to what extent Tennessee was the theatre of active hostilities from 1861 to 1865, the general government maintains seven cemeteries in the State, in which 42,000 Federal soldiers are buried.
The foundation of the Commonwealth of Tennessee by Andrew W. B. Jones, and the independence of the United States, formed a great and trying test of the valor and patriotism of the people. The Tennessee of 1776 was a country in which the war had been waged for several years. The British and the American forces were in constant冲突 with each other. The people were divided in their opinions, and the government was weak and inefficient. The Tennessee of 1776 was a country in which the war had been waged for several years. The British and the American forces were in constant conflict with each other. The people were divided in their opinions, and the government was weak and inefficient.

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Carolina could in fact be extended to them. The insurrectionary state of Franklin adopted the constitution which North Carolina had framed on declaring its independence in 1776. After the cession of North Carolina's western possessions to the United States, the organic law of the land was the act of Congress for the government of the Territory Northwest of the River Ohio, made applicable to the Southwest Territory by a separate act.

With this experience in constitution-making and having before them the newly-adopted Constitution of the United States, the people of Tennessee sent their representatives to a convention at Knoxville in 1796 to form the constitution under which they were to live as a State of the Union so soon as Congress should recognize their demand for Statehood. Like the North Carolina constitution, it was adopted in committee and not submitted to popular vote. William Blount, governor of the Southwest Territory, was president of the convention and Andrew Jackson, a member, is said to have suggested that the name of the new State should be Tennessee.

The constitution of 1796 remained unchanged until 1834 when another convention, with William B. Carter as chairman, met in response to a genuine popular demand for alterations that would bring the constitution in accord with growth of the State and the spirit of the times. A new instrument was drawn up and submitted for adoption to the electorate as established by it.

Amendments were adopted in 1835 and 1865 and in 1869 a convention to meet the following year was called by the legislature. John C. Brown was made president by the convention. In 1897 a proposal by the legislature to hold another election was disapproved by the voters and in 1904 a number of amendments submitted by the legislature were likewise rejected.

Aside from the inevitable constitutional evolution through court decisions, legislative and administrative action and the changing conditions of the people, the rapidly changing political and social life of the last generation has met with no constitutional response. Previous to the Civil War, however, the naturally gradual development of the Tennessee constitution corresponded with that of State constitutions generally. In length and complexity it advanced from the less than 5,000-word instrument adopted by North Carolina in 1776 to the 14,000-word constitution of 1870. The North Carolina constitution placed property qualifications on both voting and office-holding. In 1796 what amounted to manhood suffrage was established for freemen. The 1834 constitution omitted all property qualifications but disfranchised free negroes. The 1870 constitution contains much added detail, but few changes of general importance. The 18th century declarations of the rights of individuals have continued almost unaltered to the present.

Civil and Political History.—During the early years of Statehood the two problems of chief importance were the danger from the Indians and the settlement of land titles. The two early centres of Tennessee were far apart, divided by rough mountainous country. It was many years before one could journey from Knoxville to Nashville without crossing land in the possession of Indian tribes. Strip by strip the land was bought from the Indians by the United States government. The region between the Tennessee and the Mississippi rivers known as "the Western District" was not open to white settlement until 1818; the last lands held by the Cherokee Nation in the southeastern corner of the State, were not purchased until the treaty of New Echota.

Land titles were derived from North Carolina. Ownership was acquired through military warrants by which the State undertook to pay its soldiers in land, or by purchase, through which means much of the North Carolina paper currency was redeemed. Liberal rights of preemption were given to squatters. Upon the cession of the Tennessee country to the United States, and the later cession of the State to Tennessee, there arose a long and complicated dispute to which North Carolina, Tennessee and the United States government were parties. This matter of the public lands greatly affected the development of political, internal improvement and banking. In the earlier period speculation in land also was a noteworthy factor.

For many years John Sevier was the most prominent figure in the State's life. His influence was identified with East Tennessee, the oldest section of the State. As the middle and western parts were settled, Indian wars and national affairs brought into prominence the personality of Andrew Jackson, but when Jackson became President resentment on the part of some of his actions and against his efforts to continue domination over Tennessee politics led to the rise of a vigorous Whig party, which usually prevailed in national elections. From 1835 to 1853 Tennessee was a bitterly contested State. Its relatively large population and the closeness of its vote gave it a prominence in national politics. Hugh Lawson White, John Bell, Andrew J. Donelson were nominees for the Presidency or Vice Presidency who were unsuccessful. James K. Polk was elected President in 1844. and Andrew Johnson Vice President in 1864. The prominence of these, and host of other men, was due to the fact that Tennessee in this period constituted a type and was a true representative of the West. Within the State were signs of internal improvement, especially railroads, banking, education, were prominent in political discussion. The State was almost entirely agricultural, the population of the towns being relatively very small. Slavery existed all over the State in East Tennessee, however, there arose a decided anti-slavery movement which ran its course when the most active opponents of the system emigrated from the State. Physical differences left a positive stamp upon the attitude of the different sections of the State toward slavery. East Tennessee had relatively few slaves; the western district, on the contrary, developed like Mississippi. Sentiment in the State was conservative and devoted to the Union. The two problems of chief importance were the danger from the Indians and the settlement of land titles. The two early centres of Tennessee were far apart, divided by rough mountainous country. It was many years before one could journey from Knoxville to Nashville without crossing land
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n support of the Union. The course of events soon led to the domination of Tennessee, strongly Unionist in sympathy, by forces who kept open the communication with the Southwest to

is, while the Federal successes at Port and Fort Donelson, and the occupation of Tennessee into the possession of the Federal forces under whom Andrew Johnson appointed governor. The régime of Union..

Tennessee was perpetuated after the adoption of the new Government by devices and by the exercise of the power of the State to hold the peace of the State by its control of the resources of the State. The State has been divided into four districts, each with a territorial governor, and each with a representative in the State legislature. The State is divided into four districts, each with a territorial governor, and each with a representative in the State legislature. The State is divided into four districts, each with a territorial governor, and each with a representative in the State legislature.

The State has a population of 4,789,000, and a total of 1,081,290 females and 1,103,491 males. The total voting population is 552,668,78 per cent being white. The total number of children of school age (6 to 20 years) is 738,475. The total number of illiterates in the State (over 10 years) is 221,071, representing 13.6 per cent of the total population. As compared to 20.7 per cent in 1900. The total number of dwellings in Tennessee is 444,814. Total number of families, 462,533. Average number per family, 4.7.

Immigration.—Immigrants to the State are mostly welcomed with that geniality and hospitality which the new South has inherited from the old. Tennessee is not dominated by the arrogance of wealth, neither is it overbalanced by its city population. Prejudice of the country against the town or of town against country is a thing of the past. The numerous commercial organizations offer inducements to capital with the assurance that though a stone wall might be built about the State, yet its resources are so great and diversely scattered that a 10 times its present population would have available every necessity, every comfort and every luxury.

In conclusion, it may be said truly that Tennessee is large in area, in wealth, in industries and truly magnificent in its possibilities, and the day for indulging provincialism is forever gone.


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GEORGE C. PORTER.
TENNESSEE—TENNYSON

TENNESSEE, a large river formed by the Holston from Virginia and the French Broad from North Carolina, which unite near Knoxville, in eastern Tennessee. It flows southwest, entering Alabama in the northeastern part of the State and continuing southwest to the centre of Marshall County, where it turns northward and flows across the northern part of Alabama, re-entering Tennessee in Hardin County. From here the course of the river is nearly due north across the State of Tennessee and the western part of Kentucky to the Ohio River, which it enters at Paducah, Ky. The length of the river is about 800 miles; from the source of the Holston to the mouth of the Tennessee is about 1,200 miles; the area drained is about 40,000 square miles. It is navigable, without artificial aid, to Florence, in Lauderdale County, Ala., a distance of 280 miles from Paducah. Just above Florence are the Muscle Shoals, about 20 miles long, which are navigable for about one mile in spring. A canal has been built to overcome this obstruction to navigation. Above the Shoals, the river is navigable for light-draft steamers nearly all the year. The navigable waters of the upper course of the river, together with the Holston, are about 930 miles. The principal tributaries are the Clinch, Duck, Elk, Hiawasse, and Sequatchie rivers. The Tennessee is the largest tributary of the Ohio River, entering the Ohio 10 miles from the mouth of the Cumberland River. See BOUNDARIES OF THE UNITED STATES.

TENNESSEE, Army of the, one of the divisions of the Confederate army in the Civil War. After the battle of Shiloh (q.v.) it was commanded by General Halleck and later by Grant, Sherman and others.

TENNESSEE, University of, the State university located at Knoxville, Tenn. It was established in 1794 as Blount College; a non-sectarian institution and was incorporated by the first general assembly of the Territory southwest of the Ohio; in 1807 the name was changed to East Tennessee College and in 1840 to East Tennessee University. In 1869 the State legislature gave to the university the control of the Congressional land grant of 1862; in 1879 it was further recognized as a State institution by an act connecting it with the public schools of the State, and in that year its name was changed to the University of Tennessee. The board of trustees consists of 14 members appointed by the governor and confirmed by the senate for a term of 12 years from each Congressional district and two each from Knoxville and Memphis; the governor, the commissioner of agriculture and superintendent of public instruction, being ex officio. The university is coeducational. It comprises colleges of liberal arts, agriculture, including experiment stations, engineering and law at Knoxville; colleges of medicine, of dentistry and school of pharmacy at Memphis. Military science and drill are a part of the curricula and are required of the men students in the freshmen and sophomore classes. In 1902 a teachers' summer school was opened on the university grounds with the co-operation of the college of agriculture and the principal sciences. The university has a division of extension, including agriculture, home economics, public health, rural engineering and education. Short winter courses are given in the agricultural, home economics and engineering departments. The campus proper at Knoxville contains 39.9 acres, at Memphis 1.7 acres, and the university farms contain 1,634 acres; there are 18 buildings, including dormitories on the campus. The productive funds amount to $427,000; the annual income to approximately $800,000; the library contains 40,000 volumes. The students number 2,400 to 2,500 normally and the faculty over 250.

TENNESSEE CENTENNIAL EXPOSITION, held at Nashville, Tenn., in celebration of the State's 100th anniversary of its entrance into the Union. Its dominant purpose was to show the history and development of the State and to emphasize its resources. The site chosen was West Side Park, a former race-course, a tract of about 200 acres. More than 100 buildings were erected, and the departments included agriculture, art, commerce, construction, education and hygiene, government, history, machinery, mineral industries, transportation, women's work, etc. The president of the exposition was John W. Thomas. The total attendance was 1,780,714; the receipts were $1,101,285, exceeding by $89 the disbursements. Consult Just, The Official History of the Tennessee Centennial Exposition' (1898).

TENNIEL, ten-nil', Sir John, English cartoonist: b. London, 1820; d. 1914. He received no regular art training. In 1845 he was selected by public competition to paint a fresco in the Houses of Parliament at Westminster, but he is better known as a book-illustrator and a cartoonist in Punch, on whose staff he worked during the 50 years 1851-1901. He also illustrated a number of important books. He was knighted in 1893. His cartoons are unique in contributions to a comic paper, being of classic severity in line and expression and often tinged with a tragic seriousness of meaning which exalts their author as not only a great caricaturist but also a great poet. This can be more powerful than the political suit which characterizes the majority of them, a satire whose geniality neither deadens the life nor blunts the point of their irresistible humor.

TENNIS. See LAWN TENNIS; RACKET.

TENNYSON, Alfred, Lord, English poet: b. Somersby, Lincolnshire, 6 Aug. 1809; d. Aldworth, near Haslemere, on the border of Sussex and Surrey, 6 Oct. 1892. His boyhood was passed at his father's country rectory, in an atmosphere that was full of poetry and music; and at a very early age he began to try his wings in verse. Some of his youthful efforts were published in partnership with his elder brother Charles, in 1827, in a volume entitled 'Poems by Two Brothers.' Two years later he entered Trinity College, Cambridge, and became a member of an intimate society called 'The Apostles,' which included some of the most brilliant young men in England. Among them was Arthur Henry Hallam, the closest friend of Tennyson. In 1829 he won the Chancellor's Medal with a poem in blank-verse called 'The Princess.' (See SUMMER POET.) In 1830 he published 'Poems, Chiefly Lyrical,' a slender volume of new and delicate melodies.
er his father’s death in 1831, he left without taking his degree, and for 60 t followed he gave himself to a poet’s h a clear resolution which never volume of poems published in 1832 a distinct growth in strength and skill. it a tiny book, but there was a quality ich more than made good a lack of it be Lady of the Lake, The Isle of the l-Eaters, The Palace of Art, and um of Fair Women, revealed the of a true dreamer of dreams, gifted magic which translates visions into The Miller’s Daughter, The May and ‘New Year’s Eve,’ showed the one who felt the charm of English nery and common life with a senti- fresh and pure and deep that he on be able to lay his hand upon the r of the people.

Before this highest potency of the poet’s d come to Tennyson, there was need nism of conflict and sorrow, to purify in the mere love of art for art’s sake, hence in becoming a masterly in the art of exquisite verse—and to consecrate is to the severe and noble service of and truth. This liberating and experient was enfolded in the poem which fell upon him in Arthur Hal- liden death at Vienna, in 1833. How us irretrievable loss shook the poet’s ow closely and how strenuously it m to face the mystery and the mean- life in lonely spiritual wrestling, was closed, after 17 years, in the famous ‘Memoriam.’ But the traces of the and some of its fine results were seen lier, in the two volumes of ‘Poems’ appeared in 1842, as the fruitage of a silence. ‘Ulysses,’ ‘Morte d’Arthur,’ son Stygites,’ ‘Dora,’ ‘Locksley Hall,’ on of Sin,’ ‘The Two Voices,’ and nortal lyric, ‘Break, Break, Break,’ the work of ‘An idle singer of an empty day.’

I had entered into his poetry. His d been born again, from above. He place with the master-minstrels who s a full voice out of a full heart, not sterie, but for the age and for the 1 the recognition that Tennyson really to this higher class of poets—a on which at first was confined—to a cted circle, but spread by degrees to r reading public—that prepared an audience for his first long poem, which appeared in 1847. The sub- s the eternal “woman question,” in the form of an epic, half heroic and orous; the story of a king’s daughter right to emancipate (and even to her sex from man, by founding a L woman’s college, but was conquered or at least modified), by the love of us, chivalrous, dreamy prince, who nd married her. The story is un g. The blank verse in which it is beauty, though it is often too ornate. lusion of the poem is a superb tribute to “the eternal womanly.” But the little interludes of song which are scattered through the epic shine as the chief jewels in a setting which is not all of pure gold.

In 1850 the long-delayed and nobly-labored elegy on the death of Hallam was given to the world. It is hardly too much to say that ‘In Memoriam’ stands out, in present vision, as the most illustrious poem of the 19th century. C e r tainly it has been the most frequently trans lated, the most widely quoted, and the most deeply loved. It is far more than a splendid monument to the memory of a friend. It is an utterance of the imperishable hopes and aspirations of the human soul passing through the valley of the shadow of death. It is a unique group of lyrics, finished with an exquisite artist’s care, which is only surpassed by the intense and steady passion which fuses them into a single poem. It is the English classic on the love of immortality and the immortality of love.

In the same year with the appearance of this poem happened the two most important events, of Tennyson’s career. He was married in June to Miss Emily Sellwood, a lady of artful and beautiful endowments, who proved herself through a long line of unselsh devotion the true partner of a poet’s existence. And he was appointed in November to succeed Wordsworth as poet laureate.

His first official poem was the stately ‘Ode on the Death of the Duke of Wellington,’ in 1852. The majestic march of the verse, its freedom, its organ-toned music, its patriotic vigor, and the lofty solemnity with which it closes, give it a higher place than can be claimed for any other poetical production of an English laureate for a public occasion. ‘The Charge of the Light Brigade,’ written in 1854, was a trumpet-note that rang through England and echoed around the world.

‘Maud’ was published in 1855. It is a lyrical monodrama, in which the hero, a sensitive and morbid man, with hereditary tend ency to madness, tells the story of his re demption from misanthropy and despair by the power of a pure love, unhappy but victorious. The variety of the metrical forms in this poem, the passionate tenderness of the love songs, the beautiful truth of the descriptive passages, and the intense personality of its spirit give it a singular charm, which is felt most deeply perhaps by those who are young and in love. Tennyson himself said I think ‘Maud’ is one of my most original poems.‘

In 1859 began the publication of the epical sequence called the ‘Idylls of the King,’ the largest and in some respects the most important of the works of Tennyson. The first group contained ‘Enid,’ ‘Vivien,’ ‘Elaine’ and ‘Guinevere.’ The second group appeared in 1870, and consisted of ‘The Coming of Arthur,’ ‘The Holy Grail,’ ‘Pellae and Etta’ and ‘The Passing of Arthur.’ In 1872 ‘Gareth and Lynette’ and ‘The Last Tournament’ were published; and in 1885 ‘Balin and Balan’ was printed in the volume entitled ‘Tiresias and Other Poems.’ The division of ‘Enid’ into two parts—‘The Marriage of Geraint and ‘Geraint and Enid’—makes the epic, as it now stands, consist of 12 idylls. Each of these clothes an ancient legend from the Arthurian
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Cycle in the richest and most harmonious of modern blank verse. The idylls are so far independent that any one of them might stand alone as a complete poem. But there is a connecting thread running through them all in the threefold love-story of Arthur, Guinevere and Lancelot, and in the history of the Round Table. The underlying motive of the whole series is to shadow forth the war of Sense against Soul. The idylls are to be interpreted, therefore, as movements in a symphony, the theme of which is the rightful royalty of man's spiritual nature, seeking to establish itself in a settled reign of law, and constantly opposed by the disorderly and disintegrating elements of humanity.

In 'The Coming of Arthur,' it is doubt that threatens the kingdom; in 'Gareth and Lynette' the conflict is with false ambition; in 'The Marriage of Geraint,' with pride; in 'Geraint and Enid,' with jealousy; in 'Balin and Balan,' with suspicion; in 'Merlin and Vivien,' with lust; in 'The Holy Grail,' with whatsoever organ voice was stifled. The power of unlawful love, which has crept through all the court, and Arthur's Round Table is dissolved in ruin— but not without a vision of peace for the king who has kept his soul sustained, and a dim promise of new hope for some future age, when he shall return to bloodless victory.

Tennyson has not allowed the ethical purpose of these poems to confuse their interest or bedim their beauty. They are not in any sense an allegory. The tales of love and light-erancy, of tournament and battle and quest, are vividly told in the true romantic spirit, lighting up the olden story with the thoughts and feelings of to-day. There is perhaps a touch of over-elaborateness in the style; but after all the figures stand out as distinctly as they ought to do in such a large tapestry. In the finer idylls, like 'Guinevere' and 'The Passing of Arthur,' the blank verse moves with a grandeur and dignity, a broad, measured, fluent harmony, unrivaled in England since Milton's time.

The rest of Tennyson's poetical work includes his dramas — 'Queen Mary,' 'Harold,' 'Becket,' 'The Cup and the Falcon,' and a few others—and several volumes of miscellaneous poems, such as 'The Earl of Arden' (1881), 'His Tragic Tale' (1879), 'Ballads' (1880), 'Tresses' (1885), 'Locksley Hall Sixty Years After' (1886), 'Demeter' (1889) and 'The Death of Génon,' published posthumously in 1892. The great age to which his life was prolonged, the unwavering fidelity with which he devoted himself to the sole pursuit of his chosen art, the freshness of spirit which made him delight in labor to the very last, and the fine versatility of mind with which he turned from one field of production to another — this taught him to pass that both in amount and in variety of works Tennyson stands in the front rank of English poets; but two can be thought of — Shakespeare and Robert Browning — who produced more.

In 1883 a title of nobility was offered to Tennyson through Mr. Gladstone. This honor, which he had declined at least once before, he now accepted; and in January 1884 he was admitted (we can hardly say elevated) to the peerage — taking his title, Baron of Aldworth and Farrington, from his two country houses, in Sussex and in the Isle of Wight.

It would be difficult, of course, to size the style and estimate the various and fertile poet in a brief statement of the qualities in the Tennyson which are unmistakable and which are characteristic:

1. His diction is singularly lucid, melodic, and musical. He involves the phrase in its force and strength. Not only in his choice of metres, but choice of words and cadences, we see an influence controlling his verse. So results in a loss of force or definiteness, makes it poetry, whether in the lines of 'Locksley Hall,' or in the measures of the shorter songs, possible. Any one who recites it aloud, how natural it is to fall, as Tennyson did, into a rhythmical tone, almost like this close relation of his poetry to be felt also in the quality of subtle-ness, of intimate and indefinable charm, makes his brief lyrics as perfect as of their kind in the world's literature.

2. He has an extraordinary truthfulness of touch in natural description and appears equally in minute, pre-Raphaelite, where he speaks of the color of different trees in early spring, or in which a wave-crest is reflected in hollow before it breaks; and in landscapes, where he renders the thing, the coming storm, or the still glory of autumnal morning, in a few broad lines to this the quality of blending and interlacing all his epistles and descriptions with the poem, so that they do not the feeling but enhance and deepen, have one of the traits by which the Tennyson is most eagerly distinguished.

3. His range of imaginative sym- shown in his ballads and character very wide; but it moves for the natural and normal rather than eccentric lines, his respect from those of Browning to press the feeling of the philosopher's tius, of the peasant in 'Rizpah,' of in 'The Children's Hospital,' of the fighter in 'The Revenge,' of the intrepid lover in 'Ulysses,' in order to each, not that which is exceptional that which is most deeply human.

4. His work reflects with artistic the scientific and social movement. The discoveries and inventions of are translated into poetry. His verse the planets are molded of star-dust and of an unfinished creation is still in the possible, often, to assign dates by an allusion to a comet, or some critical event in history of mankind. It is true that many of the new devices to bring uranium. He takes a dark view of the elements of 19th century civilization he feels the forward movement would be
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Poetry mirrors truly the spirit of modernism — with shadows. In its form, so in its spirit, the verse of Tennyson expresses a constant and controlling sense of law and order. He is in the camp from the poets of revolt. Har-

ioritism is sober, steadfast, thoughtful, iding. His love moves within the bounds of purity and reverence. His conception of the absolute is never akin to blind force, but car-

thin itself the higher elements of intelligible and voluntary restraint.

Self-reverence, self-knowledge, self-control. —

These three alone lead life to sovereign power.

The poetry of Tennyson is pervaded by a nd religious spirit. His view of the —his view even of the smallest flower blossoms in the world—is illuminated through and by his faith in the Divine and goodness and beauty. He cannot see of a purely physical universe. Nothing has written could have been written as

he had been an atheist or an agnostic.

Tennyson takes more from the side of the feelings, imitate spiritual instincts and cravings of life. The strongest of these is the desire for a life beyond the grave. To this for immortality he gives full play, and it some of the strongest and sweetest tones music. From 'The Deserted House' to 'ing the Bar,' his poetry is an evidence of the conviction that death cannot end all, that in the life that is to come elevates his conception of the life that now gives a new meaning to duty and to love.

Then we think of the many noble poems he has written and expressed, — 'The Two', 'The May Queen,' 'Locksley Hall,' 'Arden,' 'The Leper's Bride,' 'Guinevere,' 'In Memoriam,' 'Vastness,' 'Wages,' may well call Tennyson the poet of the life influence upon the thought and feeling age has been far-reaching and potent. stood among the doubts and confusions of latter days as a witness for the things e invisible and eternal, — the things that ay forget if they will, but if they forget their hearts wither and the springs of run dry. His verse has brought new courage to the youth of to-day who the spirit of the invasions of materialism. In the conflict for the enlargement of faith to e the real results of science, he stood as a leader. In the great silent reaction from the desperate solitude of a age the clear bright, calling the unwilling exiles of belief again. And when he passed away from home at Aldworth, with the moonlight on his lips, the poet felt as for a mighty prophet, oiced for him as a poet who had finished

his course and kept the faith. See Enoch Arden; Idylls of the King; In Memoriam; Locksley Hall; Maud; Princess, The.

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TENNISON, Frederick, English poet: b. Louth, 5 June 1807; d. Kensignton, 26 Feb. 1898. He was elder brother of Alfred Tennyson (q.v.). He published several volumes of poems of considerable merit, namely: 'Days and Hours' (1854); 'The Isles of Greece' (1860); 'Daphne and Other Poems' (1891); and 'Poems of the Day and Year' (1895).

TENNISON-TURNER, Charles, English poet: b. Somersby, Lincolnshire, 4 July 1808; d. Cheltenham, 25 April 1879. He was an elder brother of Alfred Tennyson (q.v.), with whom he collaborated in the 'Poems' of 1827. He took the additional name of Turner by royal license on succeeding to property at the death of a great-uncle. He became vicar of Grasby, Lincolnshire, in 1837, and published 'Sonnets' (1864); 'Small Tableaux' (1868), and 'Sonnets, Lyrics and Translations' (1873). In 1880 these were reprinted with additions, under the title 'Collected Sonnets, Old and New.' These writings manifest that he possessed much poetic genius. His greater brother regarded some of his sonnets as among the finest in the language, among them being 'The Rookery'; 'Lettie's Globe'; 'Orion'; and 'The Lion's Skeleton.'

TENOCHTITLAN, ten-och-te-tlan', the ancient name of the City of Mexico. See Mexico.

TENOR, the highest natural adult male voice. Its compass generally extends from C in the bass to G or A in the treble. Professional singers may take from C to C'. The qualities of the tenor render it suitable to the expression of tender and delicate sentiments. In a vocal composition of four parts the tenor forms the second middle part, deeper than the alto, but higher than the bass; but in the song of four male voices, the tenor, as the first voice, has the chief melody, and as the second is the higher middle voice. The clef of this voice is the C clef on the fourth line of the staff, but the treble or G clef is commonly used, though an octave too high. A singer having a high-pitched voice, or a musical part for such a voice, is also termed tenor, and sometimes a voice, tuned between the bass and the alto is so named. See Voice and Voice Culture.

TENORITE, the native black oxide of copper, CuO, occurs on the lavas of Vesuvius in small black scales of brilliant metallic luster. It is susceptible to wear and weathering, and the solution formed by the decomposition of chalcopyrite and other copper ores.

It occurs in Ducktown, Tenn.; Morenci, Ariz., and elsewhere.

TENOS, te'nos, Greece. See Tinos.

TENSA, a river in the southwestern par of Alabama, the eastern channel through the united waters of the Tennessee and the Alabama rivers pass to Mobile Bay. The western channel is called Mobile River (q.v.). At the mouth of the Tensas is Fort Blakely where took place an engagement between the Union forces and the Confederates, 25 March 1862. See Fort Blakely, Siege and Capture of.

TENSKWATAWA. See Tecumseh.

TENT, a portable dwelling-place formed of flexible material, as blankets, hides or more commonly canvas, stretched with cords on poles. Tents are chiefly used in Europe and the United States as shelters for soldiers, although the fur-hunters in the country, following the Indians, made partial use of them. The most common form of tent is the A tent, having a ridge-rod across which a canvas is slung and sloped to form the main roof, the sides being fastened by cords to stakes in the ground and the wings being hung for sides. When a hoop is used instead of a ridge-rod as the main support it is a bell-tent. The circus tent usually has two or more main masts, with ridge-rod or ropes between them, and a vast spread of canvas reaching to the ground.

TENT-CATERPILLARS, caterpillars of some moth of the genus Clionarura, especially the apple-tree or spring species (C. americana) of the northeastern States. The moth is of medium size and plain colors. Its eggs are laid in autumn in the form of bands of 300 to 400 glued about the twigs of fruit-trees. They hatch early in spring, and the caterpillars begin to spin nearly forked twigs a triangular silken web or tent, in which they take shelter and grow; many other trees as well as those of the orchard are affected. They go out in the daytime to feed on foliage and at night gather inside the web, which should be burned at night when it is populous, or destroyed by a spray of kerosene. The caterpillars become pupa in June, and then a long, hairy, with a white dorsal stripe and numerous fine crinkled black lines on a yellow ground, united below into a common black band, with a blue spot on the side of each ring. Then the caterpillars spin their dense white tough cocoons behind the loose bark, or boards, and the moths appear about July 1. Another species, often very destructive to the foliage of shade trees, is the forest tent-caterpillar moth (C. disstria), whose caterpillars are to be distinguished by a row of spots instead of a line along the back. The more common tent-caterpillars of the Pacific Coast are the larva of the early C. californica and of the later C. costreca, both orchard-pests. The last-named live in colonies but do not make tents.

TENTACULIFERA, a sub-class of the Infusoria having no cilia in the adult condition but provided with them during the embryonic period. The distinguishing feature of the group is found in the so-called tentacles which are very highly differentiated organs, some adapted for piercing, while some again are adhesive. They are emitted from the entire surface of the body or occur
s at the angles. Such tentacles are capable of protrusion and retraction, and have the distal end expanded into a bulb. In structure a tentacle is tubular with a central core of thin-walled tissues. When partly retracted a band of constrictor muscles appears as a spiral ridge inside the hollow lumen. There are several branches such as Dendrocometes, sessile on plates of small fresh-water crustacea, idroroma, a larger colony, attaining a length of two millimeters and superficially an extraordinary resemblance to a zoophyte. In the latter the nucleus is an axial structure branching out from the entire colony. Young forms are by division or gemmation, and are nourished by virtue of a ciliary covering on the outer surface of the colony when the sets of tentacles are replaced by the tentacles when the colony settles down in a permanent environment.

THE CENTURY. The tenth century is esteemed as one of the lowest in achievement. Undoubtedly fewer arts and documents representing physical and intellectual accomplishment have come from it than from corresponding periods in other centuries. The principal reason for this is to be found in the almost continuous invasions of the centuries that followed. Those who were most affected by this condition were the Germans and the French, over the possession of Lorraine which culminated nearly a thousand years ago. The German emperor of that time, Otto, invaded and devastated the whole country of the Franks almost to Paris, and was forced to make a disastrous retreat and the greater part of his army perished in a battle on the Aisne.

England after the magnificent reign of Alfred continued for some time to grow in peace and prosperity. Alfred's son Edward (reigned 901-25) conquered Mercia and East Anglia, strengthened the government and protected his people against invasion by the building of many strongholds. He encouraged town development and patronized learning, founding schools, though the tradition of any connection between the Saxon schools of this time and Oxford or Cambridge is mythical. Æthelstan (925-40) further extended the Saxon rule so that all of the old Saxon Heptarchy (seven kingdoms) came under his domination. He commanded in the "great battle" famous in subsequent history against an allied army of Danes, Scots, Gaels and warriors from the Orkney Islands. These Northern peoples with their great claymores always struck terror into their enemies before this but Saxon troops proved capable of withstanding their charge. Æthelstan came to be looked upon as one of the most important kings of Europe and royal alliances with his family were eagerly sought, his sisters Edwina and Editha marrying the kings of France and Germany. He may be called the first king of all England. In the second half of the century, however, the Northmen landed in England in large numbers and gradually secured a firm foothold. The Danes under their king, Sweyn, threatened to overrun the country and their withdrawal was obtained only by paying a ransom. Needless to say this only proved to be a bait for more invaders from the Northern countries.

A more hopeful development came at the end of the century with the introduction of Hungary into European history. Stephen, one
of the chiefs of the Hungarians, was with his father received into the Church and proceeded to make his people Christian. He was crowned as king (977) and his reign is mainly in the next century, but the spirit which led him to convert little Christian Gisulf of Capua and the prelates of Cluny and to found a series of hospices for pilgrims in Jerusalem, Rome, Ravenna and Constantinople so that travelers from his country might have a refuge when they visited the holy places of the 10th century. He encouraged learning and did much to break the savage spirit of his people. His court became a refuge for the English royal family when Canute conquered the English and he deeply influenced Saint Margaret of Scotland. The tradition of social helpfulness established by him culminated in Saint Elizabeth of Hungary in the next century.

The one country in western Europe in which the Northmen were unable to gain foothold was Spain. When the Northmen landed at Galicia they devastated the country for a while, but were defeated and almost exterminated in the battle of Clontarf (939). After this, the Christian kingdom of Leon was the initial step in this and the prelude to the heroic age celebrated in the Spanish chronicles and ballads. Abderrahman III (981-993) under whom the Almoravids rose to its greatest height, was defeated in 986 by Ramiro II, king of Leon and Asturias (died 950), in the great battle on the plain of Simancas (31 July 939). After this the Christians continued to advance in power and the Arabs to recede.

The most interesting character of the period is Dunstan, archbishop of Canterbury, proclaimed saint by popular estimation of the good work he did for his people. He was probably born early in the century in a well-to-do family. In his youth he was a favorite at court until jealousy led to his banishment. Disillusioned with worldly things he became a hermit at Glastonbury but after a time the fame of his life as a solitary led the king to recall him as an adviser. Dunstan took advantage of his place at court to encourage learning and patronize art. He himself was deeply interested in the arts and crafts and the making of beautiful things and after his death he became the patron saint of the goldsmiths' guild. He is said to have taken part in the making of bells and organs as well as the altar vessels. Nothing delighted him more than the teaching of boys in the cathedral school and he encouraged manual training as well as intellectual development. The rich who saw his good work provided him with funds in abundance and he used them for the building and restoring of churches and the establishment of schools. He reformed monastic life which had suffered severely during the disturbed period while the Northmen were landing in England. Dunstan was most famous, however, for his care of the poor and the needy. He was often called upon to act as judge in law suits and his maintenance of the rights of widows and orphans made him popular. He died in 988 and until the martyrdom of Saint Thomas of Canterbury was the favorite saint of the English people.

The most significant intellectual event of the century was the writing of a series of plays by Hroswitha, a Benedictine nun of Gandersheim, St. Gall, and Cloisters of Cluny and to a series of histories for pilgrims in Jerusalem, Rome, Ravenna and Constantinople so that travelers from his country might have a refuge when they visited the holy places of the 10th century. He encouraged learning and did much to break the savage spirit of his people. His court became a refuge for the English royal family when Canute conquered the English and he deeply influenced Saint Margaret of Scotland. The tradition of social helpfulness established by him culminated in Saint Elizabeth of Hungary in the next century.

The one country in western Europe in which the Northmen were unable to gain foothold was Spain. When the Northmen landed at Galicia they devastated the country for a while, but were defeated and almost exterminated in the battle of Clontarf (939). After this, the Christian kingdom of Leon was the initial step in this and the prelude to the heroic age celebrated in the Spanish chronicles and ballads. Abderrahman III (981-993) under whom the Almoravids rose to its greatest height, was defeated in 986 by Ramiro II, king of Leon and Asturias (died 950), in the great battle on the plain of Simancas (31 July 939). After this the Christians continued to advance in power and the Arabs to recede.

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ogland was ruled by Canute. Fian ne the seat of manufactures of linens and for the cheese and the wine of id Genoa began their great com - rees in connection with the trade East. The Moors in Spain under nan III built some beautiful buildings cities, and set an example to put on an attraction for the many who came down to the Spanish to make their studies at famous schools.

AL EVENTS OF THE TENTH CENTURY.
the Elder, King of the Angles and Saxons, on of Alfred the Great, makes peace with the settled in East Anglia and Northumbria, and as the “Laws of Edward and Guthrum.” en from Norway and Denmark, from this year throughout the century, continue to ravage the Russian, British, Irish and French coasts, and although they rejected from Spain, extend their depreda - tions. They establish colonies in Normandy, upon the Danish, and in the northern islands.

duke of Franconia is elected emperor of the he Powler becomes Henry I, King of Germany, y and north Italy are divided into doksdoma - nicipalities. The third or Saxon dynasty commences with Henry I who extends his territory: increases his estates several margraves. The silver mines of G are discovered. Industry and wealth increase. The Elder, King of the English, and is “chosen as father and lord” by Saxon, Danes, Norwegians and Welsh after 16 campaigns.
the Elder dies and is succeeded by Adelinado selects the Saxon Heptarchy.

of Germany stems the Hungarian invasion, the Great succeeds his father Henry I as King and concludes peace with Louis IV of France after war.
ain breaks out over Lorraine and is ended by brother Bruno, Archbishop of Cologne.

Ungarins are finally driven out of Germany, eating them in a brilliant victory at Lechfeld. y defeats the Slavs who had ravaged Saxony, apet is made Duke of France.
ha, dramatist. Benedictine religions, and the poet, who composed "De idonis" to the emperors Otto I and Otto II.
the Martyn becomes King of England.

nd is colonized from Iceland by Northmen who Christian missionaries there. They also reach the North American continent. The dissolution of the Frankish Empire and the third dynasty, Hugh Capet the of the third dynasty is elected King of France, unestan, archbishop of Canterbury, dies.
I is crowned King of Hungary and enters into relations with Christian leaders of Western becomes a Margrave. The Grecian Empire is restored to the Bulgarians on Mount Haemus and Russian invasion. The Turks in possession of nd Syria extend their empire and give the title to their rulers.

at honorary. Villainage or serfdom is in Western Europe. The principal towns republics. Hereditary estates on a military establishment. The dukes and counts become Arab learning attains a high standard. The only education founded by Charlemagne is obliterated in the upheavals of the Frankish but faith and learning are safeguarded by the for the intellectual advancement and uplift of y.

James J. Walsh, f "The Thirteenth Greatest of Cen - JRE is a legal term denoting the reign of the which title to real estate is held, ated during the feudal system of England. Defined the relation which existed be - tween the lord of the manor and the tenant. The term tenure in its modern signification is extensive and may implicate the mere possession of real property, or the particular manner by which same may be held. A tenure paid for in services was formerly known as socage. See also FEUDAL SYSTEM.

TENURE OF OFFICE, the manner by which an office is held, as well as the duration of its term.

TENURE OF OFFICE ACTS. (1) An act of 15 May 1820 which provided a four-year term for certain officers, such as collectors of customs, etc. (2) An act of Congress passed in 1867, vetoed by President Andrew Jackson and passed over his veto on 2 March. The chief provision of the act was that requiring the consent of the Senate to the removal of any officer appointed with its advice and consent. In case of the misconduct of officers thus appointed, except judges, when the Senate was not in session, the President might suspend such officer and designate another to perform his duties until the Senate should act in the case. Many other objectionable provisions were included in the bill, which was aimed at limiting the power of President Johnson. The latter’s disregard of the act in removing E. M. Stanton from the Secretarship of State was one of the main grounds of his impeachment. Under Grant’s administration in 1869 many sections of the act were stricken out, and in 1887 it was practically repealed altogether. (See JOHNSON, ANDREW, Consult McLaughlin and Hart, “Cyclopedia of American Government” (New York 1914), and “Statutes at Large” (III, 352; XIV, 430; XVI, 6; XXIV, 500).

TEOCALLIS, té-ó-kál’ís, the ancient temples of Mexico, of which there are two which remains. They are distinguished by a pyramidal base, square in plan, and rising in stories or terraces, or in an incline of 45 degrees, to an upper platform, on which the temple stands. The most extensive is the pyramid of Cholula near Mexico, said to have been built before the arrival of the Aztecs. In plan it measures 1,440 feet each way, and has four terraces, reaching a height of 177 feet. Its area is nearly four times that of the great Egyptian pyramid at Giza, but in strength of material and skill of workmanship it is vastly inferior, and is now merely a mass of ruins. At Palenque, in Yucatan, is a better-preserved temple. The pyramid rises in an incline, consisting of an unbroken flight of steps, 280 feet square and 60 feet high. The temple is 76 feet wide in front and 26 feet deep and is ornamented with bas-reliefs in stucco and hieroglyphic tablets.

TEOSINTE, a fodder-plant. See GRASSES OF THE UNITED STATES.

TEPHIRITE. A mineral consisting of manganese ortho-silicate 2MnO·SiO₃, contains 70 per cent MnO; abundant at Franklin Furnace and Sterling Hill, N. J.

TEPIC, tā-pē’k, Mexico. (1) A territory on the Pacific Coast between the states of Jalisco and Sinaloa, organized under Mexican government in 1889; area, 11,273 square miles. It is a mountainous country inhabited by tribes of semi-independent Indians. It includes the volcano of Ceboruco, still active. The Santiago and Macquarri rivers flow through it. There are
rich mineral deposits, little operated. Pop. about
175,000. (2) The capital, Ténc, lies about 25
miles inland from the port of San Blas, with
which it is connected by a railroad. It stands
on a commanding plateau, and manufactures
cotton-cloth and tobacco, and has a population
of about 17,000.

TEPLITZ, tér'lit's, or TÖPLITZ, tér'lit's, Bohemia, a watering place in a mountain valley,
30 miles southeast of Dresden. Its interesting
features are the castle with its beautiful
grounds, the town church, bathing establish-
ment, Rathaus, etc. Its mineral baths are the
most celebrated of the country. They consist of
12 hot springs, allh-thermal, and are of
great efficacy in rheumatic affections. The
Triple Alliance between Austria, Russia and
Prussia against France was signed here in 1813.
Pop. 27,000.

TERAMO, tér'a-mó, Italy. (1) Capital of
the province of its own name, at the confluence
of the Tordino and Verzola, 40 miles northwest
of Chieti. It is a bishop's see, and the cather-
dral dates from the 14th century. The municipal
offices and the exchange are the principal
buildings. The remains of Roman baths, ther-
as and aqueducts indicate the site of the
ancient Interamna. The manufactures include wax, pottery, leather, straw hats, orna-
mental furniture and cream-of-tartar. The
ascent of the Gran Sasso is made from this point. In 1460 a fierce battle was fought here
between the Milanese allies of the king of Spain
and the forces of the Duke of Anjou of France.
The ruins of the castle of San Flaviano, in the
plains nearby, mark the site of this conflict.
Pop. of the commune about 25,070. (2) The
province lies in southern Italy, and is traversed
on the west by the Abruzzi Mountains. Several
streams flow through the province to the Adri-
atic. Wine, grain, oil and silk are the chief
products, and the fisheries are important. The
Ancona-Brendisi Railway follows the coast,
with a branch to Teramo, the capital. Pop.
320,000.

TERAPHIM, small images or objects
similar to the household gods of the Romans,
and which are mentioned in several places in
the Bible. The reverence paid to them appears
to have been very ancient. They were human
in form, and from being merely venerable, or
used as aids to devotion, might easily become
objects of idolatry. The earliest mention of
teraphim is in Genesis (ch. xxxi, 19), where
Rachel is said to have stolen her father's
teraphim, which Laban (ver. 30) calls his gods.
In the story of Micah (Judge xv, 5) the word
occurs in our Authorized Version. It was a
teraph that Micah, David's wife, put into the
bed (1 Sam. xvi, 14) to deceive the messengers
of Saul. Josiah is represented (2 Ki. xxiii, 24)
as putting away the teraphim. In Ezek. xxi,
21 they are represented as used by the king
of Babylon for purposes of divination. Con-
stantin, Benson, L. 'Hebraische Archaologie'
(Tübingen 1867).

TERATOLOGY, that branch of biological
and anatomical science which treats of abnor-
malities or monstrous growths in the structure
of plants and animals. While ancient writers
dealt with such deviations from normal types of
structure, malformations appealed to their
imagination as portents of objects of origin, rather than to their defici
tions as subjects of investigation. 18th century superstition began to
physical observation, and the study of
causation in monstrousities became
portant branch of natural history. In
the germ is regarded by many embryologists as the original cause of some human
tereditary persistence of certain defects in numerous cases resulting. Other malfo-
forms are believed to be due to disease of the brain or the uterus, and to various
disorders. Consult Moquin Tandon, 'De teratologie vegetale' (1841); Fish
's 'Transactions of the Solec Society of the State of N.Y.,
66-67-68; Masters, 'Vegetable Teratologia' (1869); Penzig, 'Pflanzenteratologie'
94'.

TETRIBUM, one of the rare minerals found chiefly in the minerals of the
gadolinite group. It belongs to the yttrium phosphate family and has an atomic weight of 158.8.

TERBORCH, tér'boors, Gé
TERBURG, tér'boorg, Gérard
TERBURY, tér'boor, Gérard
painter: h. Zwoll, near Overyssel,
Deventer, 1681. His father, a historian who had resided some time at Rome,
his first lessons in painting. He conti-
ued the study of his art at Haarlem, and
visited Germany, Italy, Spain, and France, leaving everywhere proofs of his
talent as a painter of portraits and of
On the meeting of the English Per
gress at Münster he painted in it
pleurisy. The Tria contains 69 portraits; it is now in
the National Gallery. The Spanish
Ambassador took him to Madrid,
painted the king and many of the nobles of Spain he went to London, and then
to Paris. He then returned to Overyssel,
one of his nieces and became burgom
Deventer. His portraits are remark-
ably elegant. He excelled in painting
texts and paintings, particularly the vermil
His most highly praised works are the
paintings and portraits. The latter pictures are to be found and they are
ingly costly, his 'Glass of Lemonade'
canvas, 254 by 204, fetching in
price of £9,720.

TERCEIRA, tér'shá-rá, the third
of the Azores Islands, situated 84 miles
of Saint Michael; area 25 square
is volcanic and mountainous, with a
along the shores, the highest peak is
3,500 feet. The soil is fertile, produc-
corn and grapes. The capital is a
a pop. of 11,000. Pop. of the isl
50,000.

TERCENTENNIAL EXPOSITION
JAMESTOWN. See JAMESTOWN
CENTENNIAL EXPOSITION.

TEREBRATULA, a genus of
(q.v.). The shell exhibits a puna
structure, due to the presence of numer
canals in the shell-structure itself. The
valve faces a prominent "beak," wh
for the stalk. Some species still exist as, although the genus dates back to
nian age.

**TEREDO**, or **SHIP-WORM**, a small **ivalve** boring mollusk (**Teredo navalis)**, cavates burrows in wood under **salt**
tackling the timbers of piers and ves-
sumine numbers, and riddling them to
tent that they are rendered utterly n a surprisingly short time, if left un-
. It abounds destructively throughout terranean and Baltic seas, and on both f the Atlantic. Its steady burrowings
ost caused the inundation of a large Holland. Along the sea-front had been
ystem of dikes, made principally of
In three years breaks were being up; in five, whole sections gave way.
= heroic efforts of the whole seaside in saved the Dutch from one of the
atrophes in their history. The tim-
re completely honeycombed, so rotten
wood could be crushed in the hand.
= America suffers as much as Europe is poor. All down the New England
es are attacked and destroyed. In this
wo years forms the average life of a
ubmergered timber. Channel buoys are
h water only six months in the year, new set is put in and the old one dried.
e of the ship-worm’s devastation is lively. Wood is attacked between
e above low-water mark and points more feet below it. The hardest oak
more difficulty than the softest pine, toughest knots are traversed. Teak
ights the attack.
agent of this vast amount of damage
blesses a worm, but a true mollusk.
= whitish body, tapering toward the
end, is found imbedded in a shell-lined
Individuals of this species sometimes
the length of 10 inches, are one-quarter
iometer. Such size, however, is rare,
es being the average length.
= head" end of the animal is covered
white bivalve shell. This protects the
gate, which is covered with a thin, creosote, and the orifice opening projects a short "foot"
probably the instrument by which the
is dug and lined with its pearly coating.
lets shaped and fastened to the pos-
nd of the body, much as leaves are
ed to the stem, close the teredo’s hole,
tect from attacks the soft portions of
al. Between these two plates lie the
ubes — used for inhaling and exhaling
Through the lower of these (bronchial)
the water breathed by the animal, and
those minute animalescules which serve
ood. The dorsal tube serves as the or-
excretion. Through it passes a stream
ed water carrying along the faces and
ed excavated. Surrounding both the
and the siphon tubes is a much wrinkled
band, by which the teredo adheres to row."
appearance of the teredo burrow is very

Outwardly the piece of timber in-
shows a number of very small holes. y it resembles nothing more than a
hese. The channels run in all direc-
tions, sometimes so close to each other that the
wood separating them is as thin as paper. But
between the holes there is always a partition,
for the animals never interfere with each other.
Their sense of hearing seems to enable them to
tell when they are approaching the outside of the
wood or are nearing another burrow and
they turn aside. The holes are always lined
with irregularly laid shell and they generally
go with the grain. Like many other mollusca
the teredo passes through a long series of com-
plicated metamorphoses before arriving at full
maturity. The eggs, from the beginning of the
breeding season in May, are confined in the gill
cavity. Here they have their first period of
growth. From the gill cavity the embryos are
discharged in the form of free-swimming ani-
imals covered with vibrating cilia or hairs, by
which they swim. In this stage they are almost
exactly like ciliated infusoria. Next they lose
these locomotive filaments and develop a rudimen-
tary bivalve shell. In the third stage their
relation to other bivalves is apparent in their
resemblance to the common mussel. They have
a mantle and shell covering their entire body
and another sort of cilia replaces those lost.
This bivalve character is further established
by the development of a long foot used for
creeping and by the appearance of eyes and
organs for hearing. These eyes, however, dis-
appear as the animal elongates and the loco-
motive cilia are lost. In this stage the young
teredo, settling on some convenient piece of
wood and starting with a hole about the size
of a pin-head, begins his burrow, and enlarges
it as he goes on, until he has reached his full
growth.

The fact that the ship-worm does not use as
food the wood it excavates, but simply passes
it through its body, has much to do with the
failure of many attempts to make wood teredo-
proof by poisons. Up to date creosote and
dead oils are the remedies which have given
the best results. The piece of lumber to be so
treated is first steamed. Next the air is ex-
hausted and the poisonous or noxious com-
ound is forced in under a pressure of 400
ounds to the square inch. Usually, however,
this system fails of complete desire. From
Christiania, timbers poisoned in this manner
were found to be, three years later, quite
riddled with teredo. In some instances, how-
ever, piles so treated have been known to re-
main free from ship-worms for as many as
15 to 20 years.

Although poisoned timbers are often used
for such structures as government docks (which
must be as permanent as possible), for ordinary
piers and for submerged work, the expense of
so treating the wood is greater than the
the cost of periodical renewal. Of course the
most thorough defense would be one which pre-
vented the entrance of the young animal. Cop-
per-sheathed vessels are quite free from its at-
tacks, while copper paint, creosote or coal tar
frequently applied has the same effect. Piles
may be defended by broad-headed nails closely
driven, for the ship-worm seems to avoid enter-
ing any wood impregnated with iron rust.

A large species of teredo (**T. gigantea**), from
Sumatra, has been found to measure from four
to six feet, and to have a diameter of about
three inches. It bores into the solid mud, and
TEREK.—TERHUNE.

does not appear to destroy timber like its smaller neighbor. Consult Cooke, 'Mollusca' (London 1898); Verrill 'Invertebrates of Vineyard Sound' (Washington 1873).

TEREK, té-rék', Russia, a river in Circassia, which rises in Mount Kasbek, at the north of the Caucasus, among icy glaciers. It follows a northwesterly course through a narrow valley, then turns east and after dividing into numerous branches enters the Caspian Sea by a delta. Its entire length is nearly 400 miles, only a small distance being navigable. The main tributaries are the Ardon, Uruch, Malka and Baskan on the left; the Sunsha, Assa and Argun, on the right. A series of small fortifications for protection against the mountains tribes are built along the river from Moscod to the foot of the pass over the Great Caucasus, where the descent is made into Georgia.

TERENCE, té-rénς (PUBlIIUS TerentIUS APER), Roman writer of comedies: b. Carthage, Africa, between 185 and 195 B.C.; d. probably in Greece, 159 B.C. While yet a child he was bought by Publius Terentius Lucanus, a Roman senator, who took him to Rome and gave him a liberal education. His sister having emancipated the young African now assumed the name of his benefactor. Lelian and Scipio Africanus (the destroyer of Carthage and Numantia) admitted him to their intimacy, and as some aver, assisted him in the composition of his plays. In his 24th year he went to Greece, where he is said to have translated 108 of Menander's (q.v.) comedies. Six comedies of Terence's alone are extant—the 'Andria,' the 'Ennius,' 'Hecatommiiromenos,' 'Phormio,' 'Hevra,' and the 'Adelphi;' his last piece, brought out in Rome the year before his death. The comedies of Terence were much admired by the cultivated Romans for their exquisite style, the language of Cicero, Caesar and the orators, and were likewise esteemed for those maxims and moral sentences. If we compare him with Plautus, his only important predecessor, we miss what Caesar styled the 'vis comica,' that sparkling wit and humor which made Plautus the model of Molère. On the other hand, Terence has the finer vein of sentiment, the more subtle power of characterization and the purer latinity. He was indeed the founder of polite comedy, the comedy of society in Europe and his influence has been felt throughout the whole history of literature. Most of his plays follow closely the originals of Menander, but from the fragments of Menander which remain they do not appear to be mere translations. The comedies of Terence have been translated into English by the elder Coleman and several others. (See Aen- over.) Consult 'The edition of Bentley' (1726); Vollbehr (1846); Dzitakzo (1848); and Conrad, 'Die metrische Composition der Comödien des Terentius' (1876).

TERESA, té-résą (Sp. tá-ré-sa) Saint (properly Theresia), Spanish conventional reformer: b. Avila, Old Castle, 28 March 1515; d. Alba, 4 Oct. 1582. Her attention was drawn in childhood to the lives of saints and martyrs and when she and her brother were children under 10 they set off into the country of the Moors in hopes that some infidel would seize and kill them on account of their faith and that they would thus obtain the crown of martyrdom. Defeated in their object they attempted to become hermits. Her father, a nobleman, Don de Cepeda, placed her, after the death of her devout mother, in a monastery at Avila when she was 16 and though she lived for some years there without any of her early religious enthusiasm, a change came over her at 20 and she took the veil. Her new spirit of devotion was deepened by reading the 'Confessions of Saint Augustine' and being much distressed by the apparent decay of discipline which she saw around her, she founded in 1562 another convent at Avila, dedicating it to Saint Joseph and introducing a new order, the Discalced or Barefooted Carmelites, also called Teresians. She began by making this a genuinely mendicant order, but modified this detail of the rule in obedience to her superiors. From this mother house there sprang 16 other institutions of the same order since 1525 and in later part of her life in traveling from one to another of these branch houses and the staff, cross and rosary she wore on these pilgrimages are still preserved at Avila. She was seized with her last illness in the palace of the Duchess of Avila, but at her own request was carried to her convent of San José, where she expired surrounded by her followers. Gregory XV canonized her (1622) and appointed 13 October as her festival and Urban III declared her the second patron saint of the monarchy of Saint James (Santiago) being the first. This decree was confirmed by the Cortes in 1812. She also has a worldwide reputation as a mystic, and among the most famous of the books of devotion which the Roman Catholic Church can boast are her five works: 'Discours o Réencion de Su Vida' (1562); 'El Camino de la Perfección' (1563); 'El Libro de las Fundaciones' (1577); 'El Castillo Interior' (1581); and 'Santos Concepciones del Amor de Dios.' These have been translated into most of the languages of Europe. Consult 'Saint Theresa' (edited by Cardinal Manning, 1865); Graham, 'Santa Teresa' (1834); Jameson, 'Legends of the Monastic Orders'; Thérèse et son Mysticisme' (1893); Joly, 'Saint Teresa' (1903); and 'Vie de Sainte Thérèse, Ecrite par Elle-même' (15th edition, edited by Jules Peyré, 1904).

TERHUNE, té-rún', Albert Payson, American fiction writer, traveler and journalist: b. Newark, N. J., 21 Dec. 1872. He was graduated from Columbia in 1893 and in 1898-9 traveled on horseback through Syria, investigating leper settlements, living among the Bedouins, etc. He has been connected with the New York Evening World since 1895 and is an expert writer on historical topics. His publications include 'Syria from the Saddle' (1890); 'Dr. Dale: a Story Without a Moral' (with his mother, Marion Harland, 1900); 'Caló Convoye' (1907); 'The Fighter' (1907); 'Dad' (1914); 'Damon and Pythias'; 'Golumbe Stories'; 'Stories of the Superwomen'; 'The Woman' (1912); 'Dollars and Cents' (1913); 'The Years of the Locusts' (1915), etc. He is also the author of the New York World's famous Popular Educational Series that has been running in 50 American newspapers since 1906.
TERHUNE — TERMITES

RHUNE, Mary Virginia Havens in Harland), American novelist and in domestic science; b. Amelia County, Dec. 1831. She began to write for the been 14 and in 1856 was married to Ed- tion. She conducted Baby- or two years, established the Home- n 1888, was a department editor on the Saint Nicholas and Wide-Awake and of the Philadelphia North. Her works are widely and her cook-books and articles on nd management are of practical value ensively circulated. The latter include in Sense in the Household' (1872); her Year-Book' (1877); 'Marion Har- dodel Housewife'; etc. She was the or of the movement to finish the monu- er Mary Washington’s grave and wrote erance of her purpose 'The Story of washington' (1892). Her other works 'Alone' (1854); 'The Hidden Path? Nemesis' (1860); 'Husbands and (1868); 'Loiterings in Pleasant Paths' His Great Self' (1892); 'More Colo- nestories' (1899); 'Dr. Dale,' with her P.Terhune (1900); 'Distractions of (1906); 'Where Ghosts Walk' The Long Lane' (1915), etc.

LINGUAITE, a native oxychloride gury, occurring in minute monolich in the recently-discovered mercury de- f Terlingua, Texas. It is transparent, ulphur-yellow color, brilliant adamam- grade, hardness between 2 and 3, specific 37. It is intimately associated with the mercury minerals, eglosite, and dite. See American Journal of Science XVI, September 1903.

M, in law, (1) a limited or specific of time. (2) The time during which may legally transact business. In the States terms vary according to the of judicial business and the available (3) The time set for the payment of 4) An interest or estate in land for a ace, as a year. If the term is for life hold and, therefore, treated as ready if for years only, it is merely a peri- ter, and the event is personal. (5) the period within which a party ral to produce evidence to support assert in his plea.

MINAL MORAINE. See MORAINE.

MINI MERERE. Study in the prov- falentine. In a cool, clear night of the mo- and late winter. The scene is bright, a snow, and the San. River is in a cataract where In the winter the river is frozen over. The water is very cold, and the ice is hard. The river is wide, and the water is deep. The scenery is beautiful, and the air is fresh. The snow is white, and the trees are covered with snow. The sky is blue, and the clouds are white. The river is broad, and the water is clear. The scenery is beautiful, and the air is fresh. The snow is white, and the trees are covered with snow. The sky is blue, and the clouds are white. The river is broad, and the water is clear.

MINETTE. In the garden, a type of hand- and used, it was witt- shipped in Italy as Jupiter Terminus. The or- gin of this worship was attributed to Numa, who ordered that every one should mark the boundaries of his land by stones consecrated to Jupiter Terminus and hold these stones up every year at the festival of the Termini, sacrifices of cakes, meal and fruit. This law also applied to the state, but the public termini were neglected in the later period of Roman history, while the termini of private property long retained their sacred character. A Ter- minus stood in the temple of Jupiter in the capitol. On Roman coins a Terminus is represented like the Greek Herm, a square column surmounted by a head.

TERMITES, WHITE ANTS, or DUCK- ANTS, a family of insects composing the order Isoptera, which have a superficial resemblance to ants, though far removed from them in structure, being allied to the Mayflies. They also resemble ants in being social insects, living in colonies and building masts or hives. They are widely distributed in tropical countries, but also occur in the temperate parts of North and South America and a few have established themselves in Europe. Their food consists for the most part of wood, especially in a state of incipient decay, but they also eat a great variety of substances, including dead comrades and excrement. The termite society consists for the most part of wingless, sexually immature individuals, children, potential of both sexes, which do not grow up. Besides these workers there is a less numerous caste of largeheaded, blind, strong-jawed soldiers, but these are not so well differentiated as among the true ants. The workers collect food, form bur- rows and tunnels, build "hills" and care for the males, eggs and larvae. The males and females have wings, which the latter lose after impregnation. Then, indeed, the female or queen undergoes a remarkable change, be- coming enormously distended with eggs and sometimes attaining a length of two or three inches or more. A large cylindrical package, in shape, like a sausage and as white as a bolus. As only the abdomen swells, the sur- rounding disproportion between anter and post- erior parts is very striking. The sexual dimorphism is extremely pronounced, having been known to lay 60 eggs in a minute or above 5000 eggs in a day. In the royal chamber a male also is kept. It is hardly necessary to say that the queen could not live if the queen. For to under- stand the importance of a most notice that it is spring, the young winged male and females leave the nest at a warm, after which party take place, the sexual activity of the stu- amination of the termites.

E. M.
comprise a public and a high school, 1 receipts and expenses of the munici- ount to about $7,500. Pop. 2,000.

A BAIXA. See MARTA OF THE LOW-

A COTTA, hard baked clay or 12 of exceptionally good quality, of ture, hard and durable. The 'Eng-

nace of Architecture,' completed be-

was much use in England of ma-

de with cement, speaks of it as arti-

2; but the term has also been used 3 that ancient earthenware of which the painted Greek vases which are so in the history of art, and the inferior interestings pieces of Etruria. In com-

2, however, the term is employed for 3 clay as is used in connection with e, whether in actual building, as follow mass of the baked clay takes of a stone, or where a solid casting e material is used for molded string-

ed the like, in this way replacing differs from brick in being harder, quality and molded to some special ornament.

cotta is exposed without a coating of namel, and its brown color constitutes article. Japanese figures — groups, the like — which were called "imita-

3" when they were first brought to untries are really terra cotta. They very beautiful in design, having the r of modeling and perfect finish of artis which is found in the Japanese. The raku-yaki, that interesting brown h is used for tea-jars and tea-bowls joy of the collector, is also a variety cotta.

European Middle Ages terra cotta, and also covered by a colored enamel, for roof tiles, and also for the much orate pieces employed for crestings, ially for those finials (in French h are used where the hips of the roof dge and where in this way a saiment reduced. These finials often include vane which, however, would be com-

wrought iron. The custom of using u in these ways lasted into the time ival of classic architecture, and some 3st interesting pieces are French of century: the custom not disappearing complete establishment of pseudo-

formity of design throughout Europe, ops pierced with decorative openings which the smoke might issue were also cotta and the custom still lingers nly built houses of Italy. Greece and d, where chimneys are built of hard thenware tiles set in strong cement d in this way made very light and decorative pieces were also made of tal; but in the way of architectural the most important development was Ilha Roubia ware (qui), which h-

st often spoken of as terra cotta be-

s covered completely by an opaque hich receives a most brilliant and olychromy, adding in this way color e in the most emphatic and interest-

n since antiquity. Still such pieces as

do the door-heads of many churches in Florence and elsewhere and the magnificent altar-backs; the lavabos or washing-fountains and the like throughout central Italy are among the most effective pieces to be found in that region. The most extensive and splendid work in Della Rob-
bia ware is the broad frieze of the Hospital at Pistoia.

In the 18th century terra cotta, which had always been used by the French sculptors for the permanent form of many works of art, re-

ceived a fresh impulse from the practice of Jean Antoine Houdon (q.v. see also UNITED STATES, SCULPTORS OF), Claude Michel (q.v.) (called Clodion) and others, among whom should be named certain makers of medallions as well worthy of study as the bronze medall-

ions of the Italian Renaissance. In modern French practice portrait busts are very fre-

quently made in baked clay, the same artistic quality being given them as to works in bronze or marble. The difficulty caused by the shrinking of the piece in the drying and subsequent baking is only to be met by extreme care in the selection and preparation of the material. The piece shrinks, but it may be made to shrink uniformly and without disturbing the symmetry.

Modern architectural terra cotta continually comes to the front as a material allowing of much richer treatment at a reasonable price than carved stone; but for some reason it never becomes very general in its application. A large business building in New York had its roof brackets or consols made of this material before 1855. The old Boston Museum of Fine Arts contained much decorative terra cotta brought from England and this front was com-

pleted about 1865. The constant demand for fireproof materials by means of which the exter-

ior of a large building may remain without serious damage in spite of a hot fire across the street has made concrete, brick and terra cotta the obvious material for the facing; but stone, marble and granite still retain their places in many structures.

In making monumental figures, groups, de-

signs, etc., of terra cotta the steps are: Mixing and kneading the clay; molding the clay; baking, for taking off any blemishes; baking; coloring and sometimes gilding. Modeling by hand is now rare, except in designing for a mold. The high grade work acquires its perfection largely by careful retouching. Baking requires to be performed slowly to permit evaporation of the moisture without injury. The coloring is mostly done after firing, solid body colors being employed, as browns, blues and reds, with occasional black or bright colors for sane de-

tail. Some of the Roman terra cottas are in a fine state of preservation though dating back 2,000 or more years.

Within recent years there has been a marked increase in the use of terra cotta, often colored, for ornamenting steel and concrete buildings and for roof-tiles. Consul Strack, H., 'Brick and Terra Cotta Work During the Middle Ages' (Boston 1914); Walters, H. B., 'The Art of the Greeks,' (London 1906) and the 'Annual of British School at Athens.'

TERRA DI LAVORO, têr-râ-dê lâ-vô'rô. See CASERTA.

TERRA VERDE, or VERTE (Italian "green earth"), a green mineral pigment used
by painters in oil. A deposit of this earth is found in the neighborhood of Verona, Italy. There is a similar deposit in the island of Cyprus. The native green found in Italy is a silicious earth colored by protoxide of iron, which contains about 20 per cent, and is of extreme value as a permanent and brilliant tint in landscape painting.

TERRACES, successive benches or levels along the sides of valleys. A valley may show one or several terraces, varying greatly in height and in width. If composed of rock they are known as rock terraces. These may result from the presence of hard layers of flat-lying rock, as on the sides of the Grand Canyon of the Colorado. In other cases they are the results of successive uplifts, a narrower valley each time being inscribed within the broader older valley, leaving a remnant of the older valley bottom as the terrace. Alluvial terraces are composed of stratified gravel, sand or clay. Their history is usually more complex. After a given valley has been eroded, the first step is the filling of its basin with alluvium to some depth. This may be brought about by many causes. Particularly did it occur during glacial times, when the streams flowing away from the Ice front were overloaded, filling them above their glacial outwash. Any cause which, after the valley is filled, will start the rivers to eroding, will obviously leave a gravel bench on one or both sides of the river. This renewed erosive activity may, in the case of glaciation, be merely the melting away of the glaciers, with the consequent return to normal conditions. It may be the result of uplift and rejuvenation of the streams, or it may result from climatic or other causes.

TERRACINA, tér-rá-ché'né, Italy, in the province of Rome, on a golf of the same name, near the Pontine marshes, about 18 miles north-west of Gaeta, and 56 miles southeast of Rome. It is a historical town lying on the Appian Way. It was sacked in 409 and again in 508. It is the see of a bishop and has a cathedral and handsome episcopal palace. The cathedral is built in the Italo-Byzantine style and incorporates the pillars of an ancient temple. Excavations have revealed the remains of a splendid temple of Venus. The main occupation consists in the fisheries. Pop. of the commune about 12,000.

TERRAPIN. See DIAMOND-BACK TERRAPIN; Turtles.

TERRAPIN, tér-a-pin, a tortoise of the family Emydidae. There are several different members of the family, all of which are fresh-water or tidewater. The name is also applied to the "elephant terrapin" of the Galapagos. Terrapins are held in great favor by epicures, especially in the United States.

TERRAE HAUTE, tér’é hót (French, meaning "high land"), Ind., city, county-seat of Vigo County, on the Wabash River, and on the Chicago and Eastern Illinois, the Evansville and Terre Haute, the Indianapolis, the Chicago, Terre Haute and Southeastern, and the Cleveland, Cincinnati, Chicago and Saint Louis railroad. It is 178 miles south of Chicago, 168 miles northeast of Saint Louis, 152 miles northwest of Cincinnati, and 72 miles west of Indianapolis. There are more than a
dozens lines of railroads entering
of which were built in 1905. It is most prominent railroad and
cities of the Middle West. Terre
of the oldest settlements in the State, it was laid out as a city, and in 1824 chartered.

Topography.—The city is beautiful on an elevated plateau, amid its surroundings. It is connected with side of the river by several large bridges, and for the use of the there was constructed a fine bridge (price, $27,000). There are several park
broad streets in summer time present a appearance. The residential part has
edifices in most beautiful surroundings.

Industries.—The city is in a natural region and in the centre of comprising over 2,000 square miles, a fuel supply which, at the present rate of consumption, will not be exhausted for 200 years. Coal is shipped from here to points within a radius of 400 miles. It is a distribution point for about 1,500 carloads per day. The city is the industrial and commercial center of a large portion of the western part of Illinois. The manufacturing industries embrace rolling foundries, distilleries, breweries, flour
hospitals, car works, railroad shops, factories, stamping works, feed
works, factories, and carriage factories. The vicinity are large deposits of shale and a great number of clay plants are in operation nearby. In 1910 (government census), the number of manufacturing establishments was 170; total capital invested in plants, $371,000; average employees yearly, 5,000; annual wages paid to employees, $2,219; material used during year, $8,657; annual value of products, $21,793,000; due to the failure of the natural gas supply in places, there has been since 1910 an abundant mixture of natural gas and liquid fuel. The railroad facilities accounts for the large increase in population.

Public Buildings.—The prominent buildings are the government building, county courthouse, city hall, opera house, Union station, the schools, churches, institutions, hotels and several business.

Charitable Institutions and Orphanages.—The Rose Ladies' Aid Society cares for the number of the poor, and has the home for old ladies. This home has an endowment of $100,000. The other institutions for the relief of the sick and aged are Saint Anthony's Hospital (bui in 1860), in charge of the Sisters of Charity of Charity of Providence; Rose Dispensary, endowment, $300,000; building, $130,000; Hospital (Protestant), endowment, $300,000; Rose Dispensary, endowment, $200,000; number of church aid societies.

Education.—The educational institutions are the Indiana State Normal School, which annually enrolls over 1,000 pupils; Polytechnic Institute, founded in 1883; two public elementary schools, Roman Catholic and Lutheran parish schools.
TERRELL — TERRIER

(Roman Catholic); Saint Mary’s of the Is, a school for girls; a public library and a branch, and Normal and Polytechnic Institute.

and Finances.—The three national banks have a combined capital and surplus of $1,000,000; one savings bank has depositing $1,700,000; and three loan companies, capital and surplus $1,000. The average annual cost for maintenance and operation is $400; the public school costs about $29,000; the total $50,000.

The city is governed by a mayor and council. The mayor appoints all officers, and the council appoints the city manager, who in turn appoints all other officers.

RELL, tér’él, Joseph Meriwether, politician: b. Greenville, Ga., 6 June 1819; yachtsman, b. in February in 1884 and 1886 was elected to the house of representatives. He was noted for his statesmanlike ability and was attorney-general for that State. He resigned in 1902 to accept the appointment of governor of Georgia, to which he was elected in October of that year.

RELL, Tex., city in Kaufman County, Texas, with Midland and Dallas, about 30 miles east of Dallas. It is industrial and stock-raising region, being the largest wagon cotton market in the hief manufacturing establishments are railroad shops, cottonseed mills, cotton gins, cotton compresses, and factories for the manufacture of use dresses, sun bonnets and aprons, a large trade in wheat, oats, cotton, hay, and livestock. The principal buildings are the North Texas Hospital for the poor, Carnegie Library, Elks, Home, academy, and city hall. There are churches. The educational institutions are Texas Military College, a select training school for boys with military and civil courses; two high schools (one for white and one for Negro students), graded and academic, and one private primary school. Three of the combined capital of $600,000, has a commission form of government, ative, referendum and recall features nment in hands of commission of five, each of the three wards of the city from the city at large, the functions being invested in the chairman of the commission.

Commissioners elected for two years being elected one year and three years.

The MSS. AUSTRALIANS. See La Barraca.

RESTRIAL, or CONTINENTAL, °TS, those laid down on land in continental sediments laid down in the sea may be alluvial, formed by rivers plains: glacial, formed by glaciers; wind-blown material such as sand dunes; or lacustrine, laid down in lakes. Terrestrial deposits, like marine, may consist of gravel, sand, shales, and conglomerates, sandstones and shales. Terrestrial limestones are rare, though they may form in swamps, or as wind-blown shell fragments, as the eolian limestones of Bermuda. Continental deposits are not likely to be as extensive or as regular in composition as marine beds, since the conditions under which they are formed are more variable. They are often marked by rain prints and sun cracks and by fossils of land plants and animals. See section on Sedimentary Rocks, in article on Rocks.

TERRESTRIAL MAGNETISM. See MAGNETISM.

TERRIER, the name of several small breeds of dogs. The terriers were originally used for capturing foxes and for killing rats and other vermin, and several kinds are still employed in these and similar occupations. Some are good watch-dogs, and others are useful as retrievers. The most popular variety is the fox terrier, which came into fashion about 1830. It is generally white, with a smooth, dense, hard coat; its chest is deep and not broad; neck fairly long; nose black; ears small, V-shaped, pendulous. The maximum weight is about 20 pounds, and in accordance with a cruel practice the tail is frequently docked. There is also a wire-haired variety of the fox terrier. The bull terrier, for show purposes all white since 1860, is a larger animal produced by crossing a terrier with a bulldog. It has a long, tapering head, black nose, long and slightly arched neck, wide and deep chest, short, close, stiff, glossy coat and a comparatively short, tapering tail. The Boston terrier is a new and popular American breed, of great docility, kindness and quality. The Irish terrier, a trifle larger than the fox terrier, is of a reddish-yellow, wheaten or light-brown color inclining to gray, with a hard, wiry coat free from silkiness. Its chest is deep and medium wide; head long and flat; nose black; ears V-shaped and pendulous; neck long and slightly arched, and its tail usually docked and carried high. The Scotch terrier, a smaller animal, has a rather short, wiry, very dense coat of various colors, such as steel-gray, brindle or grizzled, black, sandy and wheat. It has a tapering muzzle, black nose, small, prick or half-prick, sharp-pointed ears, short thick neck, broad and deep chest, uncult tail carried high with slight bend. The Skye terrier, the smallest of useful terriers, may be of any color. Its coat is double, the under part consisting of short, close, soft hair, and the outer part of long, hard hairs, free from curl or crisp. It has a long head, black muzzle, prick or pendant ears, deep chest, long and gently crested neck and short legs, and its tail may be carried either high or low. The Clydesdale or Paisley terrier is a kind of prick-eared, silky-coated Skye terrier. One of the modern varieties is the Welsh terrier, about the size of the fox terrier, with a close, wiry coat of sand, tan or black, grizzle and tan color. There is also an English white terrier, not unlike a small bull terrier. The Dandie Dinmont is a favorite small one, of a pepper or mustard color, with a moderately long coat consisting.
of harsh and soft hair mixed but without wiriness. Its large head is covered with soft, silky hair; nose black or dark; ears large and pendulous; tail of moderate length, with a regular row of hairs; hind feet. Bedlington terrier is a slightly larger form, somewhat similar to the Dandie Dinmont. The black-and-tan or Manchester terrier has the head long, flat, tapering; nose black; ears small, V-shaped, hanging; neck long and tapering; chest narrow and deep; tail of moderate length, tapering; coat close, smooth, short, glossy; color jet-black and mahogany tan in different parts. He was produced by long years of skilful selection by the Manchester mill-hands of England, and is one of the smartest, pluckiest vermin-killers and most interesting pets on the list. The Schipperke resembles it, but is of German origin. One of the largest of the terriers is the Airedale, with pendulous ears, deep chest, high tail, hard, being straight and close, and of a tan, black or dark grizzle color. The Yorkshire is the best known of the small top terriers. Consult Lee's 'Modern Dogs' (1896); Huntington, 'The Show Dog in America' (Providence 1901).

TERRIGENOUS, derived directly from the land, a term applied to those marine sediments like sands and clays, which are of direct land origin, as contrasted with pelagic deposits accumulating in the deep sea as the result of organic agencies, which extract their substance from solution in sea water. See section on Sedimentary Rocks in article on Rocks.

TERRITORIAL COURTS. See COURT.

TERRITORIAL EXPANSION. See UNITED STATES--TERRITORIAL EXPANSION OF.

TERRITORIAL WATERS. See INTER-NATIONAL LAW.

TERRITORIES, in the United States, certain parts of the national domain which have not been formed into States. Starting with 13 States it has been the policy of the United States in taking in new territory to require of the inhabitants evidences of fitness for self-government. This nation first added to its territory by the Louisiana Purchase, in 1803, 828,000 square miles. Florida and another territory to the total of 72,000 square miles were annexed in 1819; Texas in 1845; Oregon in 1846; the Mexican cession in 1848; Gadsden Purchase (30,000 square miles) in 1853; Alaska (591,000 square miles) in 1867; the Philippine and Hawaiian Islands in 1898; Guam and Porto Rico in 1898 and later (about 125,000 square miles); the Panama Canal Zone (436 square miles) in 1904; the Danish West Indies (now the Virgin Islands) of 142 square miles in 1917.

Of the above only the District of Columbia, Alaska and Hawaii are regarded technically as "territories." The others that have not been granted Statehood are held as "possessions." it having been decided by the United States Supreme Court in 1901, in the "Insular Cases," that Congress can create appropriate forms of government for the new territories and legislate differently for such possessions.

The Philippines are at present governed by a commission of seven members selected by the President. The commission is subject to the power of legislation and administration by the President of Congress passed in June 1902, under the power of legislation and administration by the President, and the determination of the legislature. The Philippines are now governed, provided by law, within two years following the date of enactment of the said law, if a state of government exists in the islands, an election held for members of a legislative council; to which the upper house is to consist of members of the Philippine Commission.

As this is done the powers of local government, if now exercised by the Philippine Commission, will pass to the legislative assembly. no great degree of local self-government allowed nor are the islands rep. Washington either by a commission or otherwise.

The inhabitants are not citizens of the United States and the determination of political and civil status is left to the government. The Samoan Islands and Guam are governed by military and naval governors, respectively. The unorganized domestic Territories have governor, judicature, and other officers appointed by the President, but have neither legislature nor delegate in Congress. A local self-government has recently been established in 100 incorporated towns of 300 inhabitants each. District of Columbia is governed by three commissioners, two of whom are appointed by the President from civil life and the third appointed by the engineer corps. The general charge of the administration District, including the appointment of officers, is made by the District, except the appointment of officers. The law-making body, as in the case of Alaska and the Philippine Islands, is the House of Representatives. Half the House of Representatives is from States, and the District has no delegate to the House of Representatives. If a State is admitted, the half is from the United States, and the other half by residents.

Hawaii has obligated itself to incorp- horize the inhabitants into the American Union as soon as consistent with the principles of the Constitution. All the States thus far out of territory acquired from foreign except Texas and California, have passed through the territorial stage. No general rule is the requirement of the Territory shall be as the ratio of representation in Congress; this has often been disregarded, usually for political reasons. Thus Nevada was given political purposes when its population exceeded 20,000, while Utah was admitted long after its population exceeded 20,000. For a more detailed discussion of this subject see the articles on separate State and Territory.

TERROR, Mount, Antarctic E. Mountain situated close to N. (q.v.) on the coast of Victoria Land, 30° S., and long 167° E., its height 16,945 feet. It was discovered in 1841 by Sir Ross and named after one of his ships.
TERROR, Reign of — TERRY

ROR, Reign of, the period of the Revolution extending from the downfall of the Girondists, June 1793, to that of the 

ROR, The White, the period of British reprisal in the Second Restoration, 1678-1701. It was so called from the flag (le drapeau blanc) of the Royalists, ordered to be raised by a proclamation of James II. It was also called the White Flag of Amnesty, published in 1701, but not observed by the French. It proposed a truce, by which the French army was to retire to their own territory and to pay for the losses of the English. The French, however, refused to accept the terms of the flag, and the war continued. The flag was raised again in 1702, but the terms were not accepted. The flag was again raised in 1703, but the terms were not accepted. The war continued until the signing of the Treaty of Utrecht in 1713.

TERRY, David S., American jurist: b. Todd County, Ky., 1823; d. Lathrop, Cal., 14 Aug. 1899. He served in the Texas War against Mexico under Gen. Sam Houston and later in the war between the United States and Mexico. He was a member of the California State Supreme Court in 1855 and became chief justice in 1857. He strongly opposed the procedure of the vigilance committee. In 1859 he killed Sen. D. C. Broderick in a duel near San Francisco. He had been an uncompromising opponent of the extension of slavery, particularly in Kansas, and was active in the California campaign of 1859 and in one of his speeches made certain statements regarding the war. After service in the Confederate army during the Civil War Terry resumed practice in San Francisco.

TEROUGH, Charles, British historian: b. 1864. He was educated at Kings College, Cambridge, and graduated B.A. 1886, and M.A. 1891. He lectured in history in several noted schools and was professor in the University of Aberdeen in 1888-1903. He became a well-known writer and authority on historical subjects, his best-known publications being "The Life of the Great Artists of Europe" (1899) and "The Rising of the 1745" (1900; new ed., 1903). He was awarded the Royal Society's Gold Medal (1901) for his "The Coronation of James I" (1902); "The Young Pretender" (1903); "John Graham of Claverhouse" (1903); "The Scottish Parliament" (1906); "Craig's De Unione," trans. with notes (1909); "A Short History of Europe" (3 vols., 1911-15); "Bach's Chorals" (2 vols., 1915); "The Army of the Solemn League and Covenant" (2 vols., 1917). He also prepared catalogues of the publications of the Scottish historical clubs and an index of papers relating to Scotland.

TERRY, Ellen Alice, English actress: b. Coventry, Warwickshire, 27 Feb. 1848. She is the daughter of an actor and her parents were both actors and she made her first appearance at the age of eight, under the management of Mrs. Charles Kean, at the Princess's Theatre, London. A little later she won high praise as the young Prince Arthur in "King John." During the periods of 1860-63 and 1867-68 she acted with various stock companies, first appearing with Henry Irving in 1867, at Katherine to his Petruchio in "The Taming of the Shrew." She was married early in life to G. F. Watts, the painter, but the union was dissolved and she was married to E. A. Wardell in 1864, and again on 3 May 1907 to James Carew. She was absent from the stage 1868-74 and in 1875 won her first great success as Portia in a revival of "The Merchant of Venice" at the old Prince of Wales Theatre. This she shortly followed with the title role in W. G. Will's play, "Olivia," the result being that Henry Irving made her his leading lady and the long artistic partnership at the Lyceum Theatre was commenced. Some of her impersonations at the Lyceum have been Ophelia, Portia, Desdemona, Juliet, Beatrice, Lady Macbeth, Cordelia, Margaret in "Macbeth," "Faust," the Queen in Will's "Charles I," Pauline in "The Lady of Lyons," etc. In company with Irving she has several times visited
the United States and has been invariably successful. While still with Irving she joined Mrs. Kendal and Bebohmx Tree in a revival of ‘The Merry Wives of Windsor’ at Her Majesty’s Theatre in 1902. She was honored by a jubilee performance at Drury Lane Theatre, London, in 1906. She published ‘The Russian Ballet’ (1913). Consult her autobiography, ‘Story of My Life’ (New York 1908).

TERRY, Henry Taylor, American lawyer: b. Hartford, Conn., 19 Sept. 1847. He was graduated from Yale in 1869 and was admitted to the bar in 1870. In 1876 he became professor of law at the Imperial University, Tokio, Japan, but returned to New York in 1884 and resumed practice the following year. In 1894 he again went to Japan and resumed his former position of professor of law. In 1912 he resigned his professorship and was made professor emeritus. He returned to the United States but did not resume active practice.

He is the author of ‘First Principles of Law’ (1890); ‘Leading Principles of Anglo-American Law’ (Philadelphia 1884); ‘The Common Law’ (Tokio 1895); besides various articles in American and English legal journals. He received decorations from the emperor of Japan, the Order of the Sacred Treasure (II) and of the Rising Sun (III).

TERRY, Milton Spenser, Episcopal clergyman: b. Coeymans, N. Y., 22 Feb. 1840; d. 1914. He was educated at the Charlottesville Seminary and at the Yale Divinity School. He held various pastorates near New York between 1863 and 1884 when he was made head of the Hebrew Free Neighborhood, and professor of Christian doctrine in the Garrett Biblical Institute at Evanston, III. Wesleyan University gave him the degree of S.T.D. in 1879; in 1871 he was made a member of the American Oriental Society and in 1883 of the Society of Biblical Literature and Exegesis. In 1881 he published ‘Man’s Antiquity and Language,’ which was followed by a number of scholarly publications in studies in Semitic, Biblical Hebrew, Biblical Hermeneutics (1883); ‘Silvyn Se of the 19th Century’ (1890); ‘The New Apologetics’ (1892); ‘Biblical Apologetics’ (1898); ‘Moses and the Prophets’ (1901); ‘The New and Living Way’ (1914); ‘The Mediation of Jesus Christ’ (1902); ‘The Prime of Christian Doctrine’ (1906); ‘Biblical Dogmatics’ (1907); ‘The Shinto Cult’ (1910); ‘Baccalaureate Sermons and Addresses’ (1911). He also published several Biblical commentaries.

TERTIARIES, ter’sh-ə-riz, members of the Third Order of various religious societies in the Roman Catholic Church. They are generally lay members of religious orders who follow ordinary vocations and duties in their communities, yet participate in certain work of a given order. Shortly after the institution of the Franciscan Order by Saint Francis of Assisi in the beginning of the 13th century, numbers of lay people were affiliated with the Franciscans under certain rules and restrictions, which bound them more systematically to a life of penance and devotion than ordinary persons living in the world. The regulations of the Third Order, in other words, united them to the Franciscan Order and the laity affiliated with them as proper order, uniting in one secular all over the world and regulars in community. Leo XIII recommended Order in an especial manner to the throughout the world, as a means of sanctification to be embraced by lay desired to lead a more devout life. The Dominicans also had their Te instituted by Saint Dominic himself, what year is uncertain. It was known Military Order of Christ, originally of knights and noblemen, whose duty to wage war against heretics. After the founder this became the order of the dominicenmens of Saint Dominic; for both and constituted the third order of Te These Tertiarians, without making vows, had the assurance of great spri leges through the observance of ass and prayers; they continued in the ment of their civil and domestic relation few companies of Dominican sisters Third Order, particularly in Italy, monastic life, and became regular most celebrated of whom is Saint Claire. Other religious orders after ample of the Franciscans and Dom established tertiary associations; the the hermits in the beginning of the 15th and later on the Minims, the Servi Carmelites and the Trappists. At the time there are numbers of the laity the world affiliated with the third of observing their regulations while still in their secular vocations in the work DOMINICANS.

TERTIARY PERIOD, the space geologically considered, immediately the present, and occupying the larger part of the Cenozoic era; a rock system then formed. It is preceded by the Cretaceous. Tertiary strata were at founded with the supercontinent of Europe and it was long before their re actors were realized. They occur me in patches;—some of them of origin, others of fresh-water or of co derivation. Rocks of this age were described by Cuvier and Brongniart in 18 Paris Basin, where they are well and highly fossiliferous. The shells of these deposits were recognized as differ those of the modern time, though related while the bones of quadrupeds were of extinct species. Similar strata in other parts of Europe were subsequent. Those of Italy were found in low hills the Apenines on both sides fr of the Po to Calabria and called by who studied them, the Sapinum fosils of these beds were of a mo type than those of Paris or London neighborhood of Bordeaux, in the France, another series of Tertiary dis covered and described by M. dau 1825. The several hundred species described from these beds were f
n those of the Paris Basin and those naphoapnines, and to possess an inter-
laracter between the two. Subse-
was found that strata contemporane-
ose of Bordeaux overlie the Parisian in the limestone of the English naphapnine beds in Piedmont.

and 1829 Lyell conceived the idea tertiary beds might be subdivided ac-
the percentage of living species in the strata (French conchologist, compared ) Tertiary with about 5,000 living he result arrived at was, that in the ta, or those of London and Paris, about 31 per cent of recent species, dle Tertiary of the Loire, Bordeaux, 17 per cent of recent species and er Suhapenine Tertiary from 35 to it of living species. These results resulted in 1833. In formation still eur, which Lyell studied in Sicily, y attain a vast thickness, the per-
living species was found to be 90 or these four series Lyell applied the cene, Miocene, Older Pliocene and ocene. A still later formation (Post-
was called Pleistocene, in which the all of recent types, but the mam-
y of extinct species. The most im-
egent modification of this nomenclature se introduction of the term Oligocene; to include strata formerly classed Upper Eocene and partly as Lower r. The generally recognized divisions se up are now given as Eocene Oligo-
ene and Pliocene. At present much is laid upon the numerical method ion employed by Lyell and Deshayes. tious deposits of the typical Tertiary tars, London, the Loire Basin and enne series became well known, a f comparison became established, by lar deposits of other regions could ned. This is the method employed deeding to which division a given uld belong.

nor characteristics of geography, and animal life of the Tertiary were those of the present time, but land of less extent and were more largely y interior fresh-water basins. The the early Tertiary was evidently d more moist than that of the period t, types of plants now strictly tropi-
covering areas now under Arctic nd influences. In the United States ic and Gulf coast plain under-
eated submergence and emergence. first half of the period, the site of Coast Ranges was largely under in mid-Tertiary the Coast Ranges ve line time nearly form. The great western interior one upheaval at the close of the pre-
iod (Cretaceous) in the formation g Mountains. During Tertiary these extensive buildups on the s and in the intermontane basins, beds of terrestrial gravel, sand and w lake deposits were also formed, were active during much of the in the Rocky Mountains westward,ick beds of ash and very extensive

lava flows, as on the Columbia Plateau in Oregon and Washington. Marine Tertiary beds are found on the Atlantic and Pacific coasts. The most important of these are the strata of the Atlantic coastal plain with its expansion in the Gulf of Mexico. On the Atlantic Coast the Eocene beds are mostly clays and greensands which rest unconformably upon the Cretaceous strata and are unconform-
averlay by the Miocene beds. All of these beds are highly fossiliferous, shell predomin-
ating. In the Miocene is a great bed of diatomaceous earth (q.v.) from 200 to 300 feet thick. In South Carolina, Pliocene beds make their appearance. No Oligocene strata are known from the Atlantic Coast. On the Gulf Coast the Eocene is well represented and rests upon the Cretaceous. It consists mainly of marls, greensands, clays and sands. Both Oligocene and Miocene are represented on the Gulf Coast. The Oligocene is characterized by a warm-water or subtropical fauna. The cene beds of the Gulf States represent the ad-
vent of the colder water fauna from the North. Pliocene beds of the age of those formed in South Carolina are extensively developed in Florida.

Tertiary deposits are well developed in the interior of the United States between the Miss-
sissippi River and the Rocky Mountains. They consist of non-marine strata, partly lacustrine, partly eolian and partly made up of wash from the mountain sides in the form of coarse alluvial cones or fans. In these deposits nu-
erous bones of extinct mammals are found, of which extensive collections have been gath-
ered in the various museums of the country, particularly in the American Museum of Natu-
ral History in New York. Most of the deposits are in isolated basins, and can only be correlated by their vertebrate fauna. On the Pacific Coast, all the epochs of the Tertiary are represented, being in part marine, in part terrestrial.

Life of the Tertiary.—At the close of the Cretaceous period all the flying reptiles and dinosaurs, and most of the marine reptiles, seem to have become extinct; and the Tertiary formations, so far as known, yield only forms of Vertebrata essentially similar to those of the present day. Among fishes, all of the exis-
ting suborders and many of the existing families or even genera seem to occur in the Eocene. Among the invertebrates, ammonites, belemnites and most of the crinoids had passed away when the Tertiary era began; and forms came in, whose descendants are now familiar to us. The Mammalia suddenly appeared as the dominant type on all the continents and the evolution of many of the minor groups can be traced. Primitive tapirs and primitive horses, with four toes (Orohippus and Eohippus) occur. Among the Oligocene mammals may be mentioned the Miohippus or horse with only three functional toes. The peculiar Oredon occurs in beds above the Titanotherium and represents a type intermediate between hog and deer in structure. Early camels, the ear-
est true carnivores, early bats, squirrels and rodents and marsupials also occur in these beds. Miohippus, a still more modified horse, occurs in the John Day and the Deep River beds; in the latter also occurs the oldest mastodon. In the Loup Fork beds occur Procarnus, Mastodon and dogs of the genus Canis. Con-
sult Dana, 'Manual of Geology' (New York 1895); Zittel, 'Textbook of Paleontology' (New York 1900-04); Cope, 'Vertebrata of the Tertiary Formations of the West' (Washington 1870); M'Coy, 'A Systematic Treatise on Zoological Botany' (New York 1875); Woodward, 'Vertebrate Palaeontology' (London 1898, which contains an extensive bibliography). See CENOZOIC ERA; CHEROKEE STAGE; CLAIBORNE STAGE; EOCENE; MIocene.

CHARLES LAURENCE DAKE.

TERTIUS GAUDENS (Lat.), a diplomatic phrase meaning a mischief-maker; a third party who rejoices while two others are quarrelling and hopes to profit by their disjunctions.

TERTULLIAN (Quintus Septimiua
Florens Tertullianus), ecclesiastical writer. b. Carthage, c. 160; d. c. 230. The son of a pagan centurion in the proconsular service, he received a fine literary education and became as conversant with Greek as with Latin. He studied law and probably practised it, while he displayed a mind of great ability and perception. In his writings he displayed intimate knowledge with juristic terms and methods. In early manhood (not later than the year 197) he was converted to Christianity by the admirable courage of the martyrs, although the precise date is not known. He was married, but this did not prevent him from being ordained priest, probably of the church at Carthage. About the middle of his career he publicly joined the Montanists and the vigor which he had displayed in defense of the faith against paganism was then displayed against the Church. Saint Jerome mentions certain affronts of the Roman clergy which may have provoked the fall of the great apologist. Since Tertullian was of a fiery nature, extreme and inclined to rigorism, the new prophet (as Montanism was styled) with its severity in morals and in discipline had a natural and powerful attraction for him. But his restless spirit could not long be satisfied with Montanism and he became the leader of a separate sect, called after him Tertullianists. Tertullian was the most fecund, original and powerful genius in all the history of Christian Latin literature, which he in fact created. Nearly all of his works are of a polemic character and this brings out strikingly his penetrating intelligence, vast knowledge and inspiring eloquence. His style is energetic and concise, sometimes at the expense of clearness. Saint Jerome says that he is full of ideas but difficult to read. However, his works were seldom quoted until after the 16th century renaissance. It is not easy to draw a hard and fast line between Tertullian's Catholic and Montanistic works. To the years 197-198 belong the apologetic writings 'Ad nationes' (2 books), 'Apologeticum,' 'De martyris' (4 books), 'De testimonia anime' and 'Adversus Judaeos.' Other works of approximately the same period, but of less certain date, are 'De prescriptione haereticorum,' 'De oratione,' 'De patris et filium et Spiritum sanctum,' 'De cultum,' 'De idololatria,' 'De patria' and 'Ad uxorem' (2 books). The Montanistic writings, including those tinged with Montanist as well as those wholly Montanist, are 'De corruptione virginum et virginibus velandis,' 'Adversus Hermogenem,' 'Adversus Heresum,' 'Adversus Valentinianum,' 'De anima,' 'De Christi,' 'De resurrectione carnis,' 'Ad Fraceseum,' 'De paliolo,' 'De pudicitia monomagia,' 'Ad Scapulam,' 'Ad martyrum in Scapulam.' Tertullian's 'Apologeticus' dressed about the year 197 to the provinces of the empire in which Christians, if not the first of the Latin tribes in point of time (see TERTULLIAN, SCAPULUM), is one of the first in the impetus subject and its literary beauty. Important works of Tertullian have notably the lengthy Montanistic work 'Apologia.' The Vienna 'Corpus scripturorum ecclesiasticorum' contains an edition of Tertullian's works. 'Ante-Nicene Library' contains translations nearly all of his works.

Bibliography.—The patrologies of the Church and others and the bibliographies of the Church and others and the bibliographies of the Church are not mentioned in this article. See TERTULLIAN, SCAPULUM (1903); Fuller, John, Jr., 'Tertullian and His Times' (London 1894); 'A Dictionary of Latin Biography,' Vol. IV, London 1897.

HERBERT F. V.

Sometime of the Department of Latin, University of America.

TESLA, Tesla, Nicola: b. in the province of Lika, Austrian Croatia, in early education in Gospić, attended a Real Schule, Karlstadt, against 1873; studied at the Technische Schule, Graz, capital of Croatia, the intention of becoming a professor of mathematics and physics, but became interested in electricity and took up and completed his engineering course. He afterward studied telegraphy and languages at Prague and Munich, keeping up meantime his electrical engineering studies. For some time he was employed in the government telegraph engineering department as an assistant and when invented several improvements which attracted attention. Then he became engineer for a lighting company in Paris and next in attention to the United States as a pioneer in the field of electrical and experience. He formed a connection with the Edison company at Orange, N. J., but gave up this engagement in order to be entirely free in his work. He has made himself well known throughout the many practical inventions and the brilliancy of his ideas as to the possibilities of electrical science. These ideas aroused widespread interest, have in degree diverted attention from the contributions of Tesla to the world of electrical science, and most of which were developed in the Tesla laboratory which he established for the purpose of electrical research. Tesla's researches in electric created a new field of electrical research in which the possibilities of electrical science have been exhausted. He was the first to conceive an effective method of undulating current, converting electrical energy more simply, effectively and economically than by the direct current. He invented the modern principle of the
field, embodied in the apparatus used
anmision of power from Niagara
has also invented many new forms
as, transformers, induction coils, con-
are and incandescent lamps, the oscil-
ating steam-engines, and dynamos, etc.
Farlin, T. C., 'Inventions, Researches
ings of Nicola Tesla' (1894) and the
ectrical trade journals.

RETTA. See TREASURY, THE LITTLE
OF THE D'URBERVILLES, the
in the novels of Thomas Hardy,
shed in 1891. The sub-title, "A Pure
fully Presented," explains Hardy's
ough technically guilty of an of-
ociety and ultimately hanged
mer of her seducer, the heroine,
resented throughout as the victim
stance or, more exactly and more
ically of the author, as the victim
ant and malignant fate. This is per-
in the brutal and emotional Aesch
le, but it is also quite as destructive
istic temperament, of everyday life
are. The main point appears in the
phrase in the last paragraph of the
uicide was done and the President
notions (in Aeschylean phrase) had
port with Tess." The tragedy, as
ardy's more sombre stories, is in-
ful. As in the best of the
ovels, there is the usual fully and
drawn background of local scenery
mbers, whose characters are carefully
id are vivid portraits of local types
duals. The novel is rich in rural and
enes, of which the description in the
le the seven "phases" of the book is
ily skilful and beautiful. On pub-
 Tess of the D'Urbervilles" attracted
eal of attention by reason of its sub-
treatment of which was thought to
and to too searching an attack on
s, but the literary and poetical skill
or has never been better displayed
he descriptions of customs, life and

William T. Brewster.

-PAPER, slips of unsized paper
olutions of vegetable coloring mat-
a are liable to the presence of acids
is, and, in some instances, of special
ounds. The most common test-
itmus and turmeric papers; the
apers are colored with an aqueous
le of a blue substance obtained from
pecies of lichens, the latter with a
pirit of a yellow powder obtained
ng the roots of a species of Curcuma
 in India and Java. Blue litmus is
acid, the blue color being again by
alkalis; turmeric is turned brown.
There are also pheno-phthalein and
al paper, which cannot be classed as
coloring matters, though organic,
use of papers soaked in inorganic
is, is not infrequent in analytical

-AMENT. See Bible.

ICLE, one of the two genital glands
le in which the spermatozoa and some
 constituents of the semen are
formed; a testis. The term is also applied
either of the posterior tubercles of the optic
lobes or corpora quadrigemina. The testicle
proper lies in the scrotum, is of an oval form
and is mostly invested with a pouch or closed
space of serous membrane, the tunica vaginalis,
derived from the peritoneum during the descent
of the gland from the abdomen into the
scrotum. The organ consists of a central por-
tion or body, an upper enlarged extremity, the
globus major or head, and a lower extremity, the
globus minor or tail. Lying upon the pos-
terior border of the testicle is a long narrow
flattened body, the epididymis. To this border
is attached the spermatic cord, composed of
arteries, veins, lymphatics and nerves, con-
ected together by areolar tissues and invested
with fascia. This cord ends in the internal
abdominal ring. It is accompanied by the vas
deferens, the excretory duct of the testis (a
continuation of the epididymis), which passes
through the ring into the pelvis to the base of
the bladder, where it unites with the duct of
the vesicula seminalis to form the ejaculatory
duct, which terminates in a slit-like orifice in
the prostatic portion of the urethra. Underneath
the tunica vaginalis is the tunica albuginea,
or fibrous covering of the testicle, and beneath
this coat is the tunica vasculosa, or vascular tunic,
composed of a plexus of blood vessels, united
by delicate areolar tissue. The glandular-
lar structure of the testis consists of from 250
to 400 lobules, each composed of from one to
three or more minute convoluted tubes, the
tubuli seminiferi. These tubules unite into
larger tubes, which carry the seminal fluid
from the testis to the epididymis.

The testicle is subject to hypertrophy, atrophy,
injuries, acute or chronic inflammation,
cystic diseases, fibroma, malignant disease and
neuralgia. Inflammation of the testicle (or-
chitis), as that of the epididymis (epididymitis,
q.v.), is usually attended with much pain
and swelling and a feeling of weight and great
discomfort. The use of a properly fitting sus-
pensory bandage affords much relief; but the
treatment of diseases or disorders of the testicle
should be entrusted to a physician. (See also
Spermatozoa). The removal of both testicles
renders a man impotent—a eunuch. Castra-
tion is the surgical operation of removing the
testicles, and is performed on horses, steers,
etc., to render them more docile and tractable.
It is generally recognized that castration re-
duces the will power and interferes with various
brain functions.

TESTIMONY, in general, the evidence
given by a witness orally in a legal proceeding;
from the Latin testimonium (testimony);
teslis, a witness. It may be secured during a
trial in court, or before a duly authorized com-
mmission. Although commonly so used "testi-
mony" is not synonymous with "evidence"
which is of broader significance and may in-
clude papers marked in a proceeding. Testi-
mony is usually deducted through questions
asked directly by counsel which may be fol-
lowed by cross-examination and redirect ex-
amination. (See Evidence). Consult Wellman,
F., 'The Art of Cross-Examining' (New York
1903); Wrottesley, F. 'The Examination of
Witnesse in Court' (London 1910, rev. ed.).
TESTIMONY, Psychology of. Applied psychology recognizes three groups of problems bearing on certain evidence in law. These deal with the part of a witness, the possibility of learning if he is concealing important facts; and the mental condition of the accused. Both lawyers and judges understand that differences in evidence given when both perception and memory are concerned do not necessarily imply dishonesty. Payton shows that individual differences may be expected and that by carefully comparing the effect of such differences a fair amount of accuracy may be attained. By carefully questioning observers of an enacted scene it has been found that errorless reports are an exception, that a narrative form gives greater accuracy and that both range and accuracy in reporting increase with practice and may be thus made nearly perfect. The reaction experiment has given excellent results but still lacks perfection. If it is desired to learn whether the mind of a witness or accused person is normal, the usual mental tests may be applied with good success. See CRIMINOLOGY; SULLIVAN, H. C. 'Criminal Psychology' (Boston 1911); Jung, C. J. 'The Association Method' (in American Journal of Psychology, Vol. XXI, Worcester 1910); Münsterberg, H., 'On the Witness Stand' (New York 1908); id., 'Psychology, General and Applied' (New York 1914); Whipple, G. M., 'The Observer as Reporter' (in Psychological Bulletin, Vol. VI, Baltimore 1909).

TESTING, in chemistry. See ANALYSIS.

TESTING MACHINES. Testing machines are employed to determine the physical properties of metals, and other materials such as cement, used for engineering and structural purposes. They are used especially in the testing of steel. The prime requisite of a material to be used in engineering operations is the property termed "strength," which is its capability to withstand the action of forces that may be applied to it in various ways so as to produce tensile, compressive, bending, shearing and twisting strains. Very often the force applied is a combination of two or more of these strains or stresses, and the metal is called to meet the tests of abrasion or wear. Physical tests are of two general classes — those made to determine the suitability of a grade of material for a particular purpose, and those by which the effects of differences in chemical composition, and different methods of manufacture, on the properties of the material, are studied scientifically.

The most satisfactory method that may be employed for this purpose is to actually load a specimen of the material under test and gradually increase the load up to the breaking weight, and observe the effects thus produced. Such a method, however, is too slow and cumbersome, since the loads required for even the simplest commercial tests are very seldom less than 50,000 pounds, and loads ranging from 150,000 to 250,000 pounds are commonly used, and make the direct application of weight impracticable in most cases. Therefore, various machines have been devised by which any load, from the smallest that is perceptible to the subject, to the breaking load, may be readily applied and its weight accurately determined.

Of these are two general types — those by which the specimen is loaded by hydraulic press, and those employing generally combined with a train of straining, rupturing or crushing pieces without injury to the machine, while measuring or weighing the strains, is the testing machine, which has frictionless weights, weighing heads, and is large enough to test the strain of important materials. Its disadvantages are due to the difficulty of keeping the load filled with a suitable liquid, the difficulty of keeping the packing of the plungers in order and the intermittent application of load by the strokes of the pump.

In both types the load is applied in a way that it acts through some form of machine which enables the operator to determine instantly the weight of the load amount of the force being applied.

The general construction of the machine is shown by the accompanying diagram. The Kiehl machine, which may be used to subject a suitable specimen of the three classes of strains — direct, direct compression and the transverse bending, so that the weight of the load can be accurately determined. Referring to the illustration, the open sliding head (a) may be moved up or down the two screws (bh) which are operated by power derived from any convenient source transmitted by belts on the pulleys (cc) of the machine, which are loose on their shafts, and be driven with a cross belt on one and an on the other side in opposite direction. Each lever (d) actuates friction clutches (e) and the motion of the pulleys with its shaft is communicated to the gearing and thus raises or lowers the head (a). By using the lever (f) and the wheel (g), the clutches may be so combined as to give various speeds to the sliding mass, which may be required in different classes of The stationary head (x) is supported by guides which rests upon the platform of the scale. The weighing beam (l) carries a movable counterpoise which works on rollers along the beam, but (m) operates a screw or chain which is the top of the beam and enables the operator to bring the counterpoise in line with the weight of the loading to be determined.
poise out along the beam gradually as is increased and thus observe con-
weight of the load being applied. In the poise may be arranged to be
advised and in side as shown in Fig. 5. The set is then drawn down by the screws, null on the specimen presses the stand-
the head (g) down upon the platform of
and causes the weighing beam to rise, pression test, the specimen is placed
platform of the scale and the sliding
lawn down upon it. In a transverse
test, the specimen is placed on two
covered by a heavy frame which is
son the platform of the scale and the
plied by means of a projection on the
e of the sliding head which presses
centre of the specimen when the head
down.
ner machine of the screw type in exten-
is that built by Tinitus Olsen. It is
principle to the Richelé, but it employs
ws to operate the sliding head.
achines are not only used to test
icarius, but may also be used to test
ent and other classes of building ma-
test cementing, small briquets of the
are made with a predetermined cross-
a area at the centre and are then sub-
the test as any other specimen: testing of metals, the tensile test gives
est and most reliable data for deter-
properties of the greatest interest in
ng operations.
UDINATA, an order or sub-class of
(q.v.) containing the turtles or tor-
er CHelonIA.
UDO, among the ancient Romans a
creen which a body of troops formed
r oblong shields, by holding them over
standing close to each other.
er somewhat resembled the back of a,
and served to shelter the men from
rom above. The name was
 a structure movable on wheels
rs for protecting sappers in under-
defenses of an enemy.
ANUS, a disease characterized by
some or all of the voluntary muscles.
s vary in rigidity, and strong ex-
ns attend their recurrence. Tetanus
oxemia, and occurs in several varie-
most familiar of which is lockjaw
, whence it is commonly called by this
he disease in all its forms (tetanus ne-
uerperal tetanus, idiopathic, trau-
 rheumatic tetanus) is caused by the
bacillus, which was discovered by
84. Kitasato cultivated it in
bacillus in a slender rod, roust-
xing in surface soil, dust, manure,
as a rule occurring singly except in
It lodges in some wound, often a
unnoticed wound, and the produc-
de disease is always a proof of its
Exempt from this rule, however, is the bacilli not pass beyond the point of infection
into the body. The real nature of the tetanus poison has not yet been determined, but its
virulence is deadly in the extreme, and it is rapidly absorbed by the body in which it has
found lodgment. It is carried through the body in the blood.
In milder cases the spasm of tetanus may be
localized in certain muscles. Various the-
tories regarding the action of the poison have
been held by pathologists and the satisfactory
explanation is still being sought by specialists
in bacteriology and toxicology. Following
childbirth, tetanus may infect both mother and
child, and the average death rate from this
disease, always high, is especially so among
children. Surgical operations are sometimes fol-
lowed by tetanus, but antiseptic surgery has
doubtless lessened its frequency, and among
diseases it is regarded as rare. Within about
10 days after an injury resulting in the infec-
tion, it sets in, the muscles along the
neck and those of mastication being usually
first affected. The patient can neither mastic-
ate nor freely open his mouth. Often the
progress to general rigidity of the muscles is
very rapid, and convulsions of extreme viol-
ence ensue. Respiration is arrested and death
is often caused by this suspension. In other
cases it results from spasm of the glottis,
or from exhaustion produced by the violence of
spasms.
There is no satisfactory treatment of tet-
anus, but such as physicians adopt is both local
and general. Nothing is more important than
careful cleansing of wounds, however slight,
for precautionary purposes. Antitoxic disin-
fectants must be used, capable of destroying
the poison produced by the bacilli as well as
the bacilli themselves. Iodine solutions should
be thoroughly applied to every tetanus wound.
Potassium bromide, chloral, calahar bean, mor-
phine and antimony produce good results, and
opium and chloroform are employed for their
quieting effects. Amputation is sometimes re-
sorted to. Increase of fluids in the body by
drinking or by intravenous injection, and the
increase of diuresis aid in eliminating the
poison. Antitoxin serum (see SERUM THERAPY), prepared from the blood of
the immunized horse, has proved a true remedy
for tetanus, and many cures have been affected
by its early administration. Preventive meth-
ods, especially those of inoculation, are now
receiving the earnest attention of specialists.
Consult Wallace, ‘Indian Medical Record’
(1891); Roux, ‘Annales de l’Institut Pasteur’
(1893); Bassano, ‘Recherches experimentales
sur l’origine microbienne du Tetanos’
(1900); Moschowitz, ‘Tetanus’ in ‘Annals of
Surgery’ (1900), Osler, W., ‘Annals of Medicine’
(New York 1915).

TETON MOUNTAINS, Wyoming, a very
high and rugged granite range on the west
side of Jackson Hole south of Yellowstone
Park in the northwestern part of the State.
The highest peak, Grand Teton, is 13,747 feet
above sea-level. It is 17 feet higher than Fre-
mont Peak and 38 feet lower than Gannett
Peak of the Wind River range, the latter the
highest point in Wyoming and the northern
Rocky Mountain region.

TETRACHORD, in music, a scale-series
of four notes. The word in its present use
signifies a half of the octave scale. The fundamental system in ancient music was the tetra-
chord, or system of four sounds, of which the extremes were at the interval of a fourth. It	was superseded by the hexachord. See Music.

TETRACYMITE, a native bismuth tellu-
rude, often containing some sulphur and a trace of selenium. It occurs in pale steel-gray, met-
talic, foliated masses, in scales or more rarely in small rhombohedral crystals. It is soft	and gets marked paper, its hardness being 1.5 to 2; while its specific gravity is high, 7.2 to 7.6. It occurs in Austria, Sweden and various localities in Virginia, North and South Car-
olina, Georgia, Arizona and Montana. It is also called telluric bismuth.

TETRAGRAMMATON, a Greek term	meaning "the word of four letters," and applied to the sacred Hebrew name of the Deity. It was considered improper to pronounce the divine name, and, therefore, an abbreviation of four letters was substituted, the most fa-
vorite being Y H W H," which occurs 3,800	times in the Masoretic text of the Bible. The true name of God was uttered by the ancient	Jewish priests only during worship in the temple. On the day of atonement the service required the high priest to pronounce it 10 times; but it was held to be impious to pronounce the sacred name promiscuously, hence this tetra-
grammaton "Y H W H" came to be pronounced by readers as Ya be, Ia be, Yave, Yahm, Iae, Yah, etc. For some reason it also became cus-
tomary to mark paper, its hardness being 1.5 to 2; while its specific gravity is high, 7.2 to 7.6. It occurs in Austria, Sweden and various localities in Virginia, North and South Car-
olina, Georgia, Arizona and Montana. It is also called telluric bismuth.

TETRAHEDRITE, or GRAY COPPER,
a common and valuable ore of copper and silver. It is essentially a copper sulphantimon-
ite, differing from tenanteite into which it passes by insensible gradations only in the pre-
ponderance of antimony instead of the arsenic which distinguishes the latter. Its color and streak are usually steel gray; it often has a brilliant metallic lustre; its hardness varies widely from 3 to 4.5; its specific gravity is also quite variable, being from 4.6 to 5.1 in ordinary tetrahedrite, 4.5 to 5 in the argentifer-
ous varieties (freibergite), 4.7 to 5.03 in the mercurial varieties (schwartzite). It crystal-
lizes in the isometric system and owes its name to the fact that its crystals are invariably of tetrahexagonal form. It occurs at many localities in Austria, Germany, Eng-
land and Colorado, and is very widely distributed in massive form in copper and silver mines all over the world.

TETRARCH, tē-trárk or têt-rák (Greek
tetraark), a term which meant the ruler of one-
eighth of an empire or of a country, as it was applied by the Romans to subordinate princes with
territories, especially in Palestine and other parts of Syria in the early Christian period. The sons of Herod the Great, Philip and Herod Antipas, who reo	the lesser shares of his realm, were tetrarchs, while Archelaus, who received the principal portion, had the title of ethnarch.

TETRAZZINI, Luise, Italian soprano Florence, 1874. While yet a child she per-
formed several operas and her sister (afterward wife of Campanini) on the operatic stage. She studied at the Liceo Musicale in Florence and after but three months had made her début in "L'Africaine" in 1893, the part of "Irene." She afterward sang in several Italian cities and her continental successes were so great that she was called second Patti. Finally she made such a success at Covent Garden that Oscar Hamme	secured her in 1908 for the Manhattan House in New York. Her operatic career was continuous and she made a number of successful concert tours. As a singer she was noted for a voice of phenomenal power and great flexibility, coupled with unequaled technical perfection. See a coloratura soprano.

TETUAN, tē-tōo-ân', Morocco, a town on the northern coast of Africa, 33 miles east of Tangiers. It is defended by a fort. It is the only open port of the country on the Mediterranean, and has a short distance of Gibraltar. It is well built and many of the handsome private residences are the homes of Moorish exiles from Spain. The town is surrounded by flourishing gardens, groves and orchards. The Hebrew merchants carry on a large trade in fruit, wool, silk, girdles, leather and cereals. Provisions are exported to Ceuta.

TETZEL, tē-tzēl, or TEZEL, J.
agent for papal indulgences in England about 1453; d. there, August 1519. He was ordained toward the end of the 15th century. He soon began to appear in public as a preacher and gained a great reputation for his orational gifts. When in 1514 Leo X issued a proclamation granting an indulgence to all who would contribute to the building of Saint Peter's at Rome, Tetzel was selected to preach those provinces subject to the jurisdiction of the archbishop of Mainz. Luther was one of those against this indulgence who were answered by Tetzel and the decision of Wittenberg burned the annulling market place. Tetzel himself received a severe reprimand from the papal court who was sent to settle the dispute. Indicted at Rome from the charges which had been brought against him, he died in prison in the Dominican Convent. His life has been the occasion of a controversy owing to the part he took in the break of the Reformation, but recent investigation has shown how much to rehabilitate his character. His life has been written by C. H. M. (1840); by Körner (1880), and by K. H. G. (1883).

TETRYL. Tetryl is an explosive substance having the formula NO₂C₃NO₂, whose structure is tetryl azide or preferably trinitrophenylamine.
Another common name in use for it is prepared by dissolving lime in sulphuric acid and treating this with nitric acid. Pure tetryl looks like a yellow tint. It fuses at C. and solidifies at 128.7°. Its heat of combustion is 40.8 calories. It is more powerful in TNT or picric acid but more sensibly so. It is used as reinforcement for detonators, as the explosive core of a booster for high explosives and as a component of some nitrate explosives such as Foster, and is costly for general use. It is some-

sonous, producing an irritation of the

TEUFFEL — TEUTONIC LANG UAGES

FFEL, tōfél, Blanche Willis How-
ness von, American novelist; d. Ban-
ne, 21 July 1847; d. Munich, Germany, 98. She was educated in New York, 78 she removed to Stuttgart, Germany, 19 engaged in teaching and also edited years a magazine printed in Eng-

ger. It was engaged with Baron von Teuffel and publications include a book of One Year Ahead (1877), and among others are One Summer (1875); Aunt (1886); No Heroes, a story for girls; Seven on the Highway, short (1897), etc.; and her works published mostly are Dionysius the Weaver's Darkest (1899), and Garden of 1900.

TOBURGER WALD, tōbô-boorg-ér-
mann, in Westphalia, a series of hills, which begin on the bank of the Oder, near Warburg, and pass northwards to Driburg, northwards to Orlinghausen, Bielefeld and Halle, Nether and Tecklenburg, and are broken by hills near Bevergern. Under the latter, they appear like a long wall; the highest, Vommerstedt, is 1,400 feet. There are, two lower parallel ranges. The sec-
t is the Lippische Wald, also called better for some authorities to be Teutoburger Wald. The third sec-
ades the Ravensberg, Osnabrücken and Turg Mountains. The name is taken from 21 years, where an account is given of the Roman general Quintilius Varus in the 1st century A.D. The 1 monument on the Gronenburg com-

TONES, tō-tō-nēz. See Germany.

TONIC KNIGHTS, one of the three liturgical and religious orders which origin-
t the time of the Crusades. Its name is derived from a German capital founded in 1128. The Tonic order takes Augustinian life, and, in to the ordinary monastic vows, the took upon themselves special oblige-

cent against the contrary of the Christian to attend sick and wounded pilgrims. ler received charters from the Pope emperor enlisting it to the same privi-

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TEUTONIC LANG UAGES. The Teu-

tonic, or Germanic, languages are unmistakably of a common origin. They comprise English, German, Frisian, Flemish, Danish, Norwegian, Icelandic and Gothic. The latter prevailed from the 4th to the 7th centuries A.D. over a large portion of the south-west and southeast of Europe, and in it we find the oldest written documents; however, both the Goths themselves and Gothic are now wholly extinct. German again includes both High and Low German, with their varying dialects, often differing very materially in their structure from each other. All these tongues, though deriving as they do from a common source, have differentiated greatly in historic times, so much so that most of them are quite unintelligible to the members of the other branches. Again, as far as written records are concerned, these date from very different periods. Thus, we know the Bible translation of Bishop Ulfilas (Wolf) of the Ostrogoths, parts of which in a fair state of preservation are kept in the University Library of Upsala, Sweden, and dating from the 4th century. This trans-

translation manifestly shows that Gothic even at that early time was a highly articulate language. Anglo-Saxon literature takes its rise in the 7th century, though some earlier fragments are probably incorporated in later works. The earliest German records date from the 9th century. In that of the Dutch from the 9th century. Frisian, a subdivision of certain very marked characteristics, does not become known to us by as much as a line till the 12th century, and in that century, too, the Scandinavian tongues for the first time make an appearance in preserved records, though it is not till the 15th century really that much of this is visible. Not until the last-mentioned period, either, do Swedish, Danish and Norwegian begin to contrast sharply in their interior construction and phonetics. Icelandic went its own course, on the other hand, being little influenced, by reason of geographical remoteness, by the cognate tongues further south. However, these northern idioms are at least rich in comparatively early inscriptions, in Runic characters, and afford much food to the philological searcher. Likewise both inscriptions and other early literary remnants discovered in the northern lands exhibit all the various stages of develop-

ment, back even to a few types (like Icelandic).
more archaic and rude than Gothic and dating from as early as the 3d century A.D. Moreover, some deductions as to the general style of the various early Teutonic dialects spoken by those tribes with whom the Romans came into contact from a. e. 150 to about a. d. 350 may be drawn from that of another group of Teutonic chiefs and other men of prominence, as these names were usually emblematic and compounded of descriptive adjectives or nouns, and these would show that on the whole during these 500 years the Teutonic vernaculars were fairly constant and not subject to rapid changes.

Certainly, the Germanic languages stand out clear and well-defined as a separate group of the Indo-European family, their nearest relationship being, in some respects, with the Italic and Celtic, in others with the Slavic tongues, and forming part of the western division. Most characteristic for the Teutonic idioms, from the philological point of view, is their manner of using the Indo-European explosive sounds, which were lost or new consonants injected; n, for example, was eliminated before the s; final explosives and nasals were thrown out; their vowel system was in a general way a close assimilation to that of our vowels, as also our consonant sounds. The accent in the Teutonic tongues shifted, after remaining indeterminate for ages, to the first syllable. This must have been as early as a. e. 100. Alliteration was employed in a great deal, both in ordinary prose and in poetry, and this as far back as the time of the Cerausci, during the Augustan era of Rome. Alliteration also served to distinguish leading families or tribes from each other, the letter s, for instance, serving the Scambri as a special mark of this nature. It was similar in the case of other Teutonic idioms. The phonetic characteristics, too, seem to have become fixed about the beginning of the Christian era. Dialectical differences existed even then, but were not nearly so pronounced as they have become since, a fact which the most ancient Runic inscriptions emphasize. On the whole, the Teutonic languages in their most primitive forms with which we are acquainted were more melodious than in full verse and not so overburdened with consonants as we find them now. Gothic, which at a very early stage became separated from the body of the language by reason of far wanderings and long-continued influences exercised on it by the adjoining and surrounding Latin and Greek populations, underwent a number of important emphatic changes. So much so indeed that after the lapse of some three or four centuries of this influence Gothic, as spoken both by Ostrogoths and Visigoths, as also by the Vandals, Goths and other eastern Teutonic tribes, must have become scarcely intelligible to their kin who had remained on Germanic soil. This becomes reasonably certain by comparing the literal translation of Úfbola with contemporaneous specimens of German or Scandinavian. The latter two linguistic bodies, however, seem to have undergone their greatest internal alterations during the 6th and 7th centuries A.D. The vernacular of the Vandals, Goths and other eastern Teutonic tribes seriously differed from the Gothic. As for the chief parts of the early Germanic grammar, of the three numbers in vogue in Indo-European languages, the dual does not seem to have been used in the Teutonic idioms. In cases taken over from early Ar-}

Bibilography.—Bühhning, K., "Linguis Elementarbuch" (Heidelberg 1898); "Althochdeutsche Grammatik" (2d ed., ib. 1891); Brugmann, K., "Die Geschichte der Vergleichsmatik der indogermanischen Sprachen" (1885); "Comparative Grammar of the Indo-German Languages" (1895); Dieter, F., "Syntax der Altgermanischen Sprache" (Leipzig 1900); Gramm, J., "Deutsche Sprachwissenschaft" (2d ed., Berlin 1890); Kluge, F., "Nominativ und Formlehre der Altsächsischen" (Leipzig 1896); Noreen, A., "Altnordische Grammatik" (2d ed., Halle 1892); "Abras Smarririgala" (Strasbourg 1875); "Altnordisches Wörterbuch" (Halberstadt 1872); Sieb, Th., "Geschichte der altgermanischen Sprache" (2d ed., Strasbourg 1875); "Urgermanische Grammatik" (1897); Verner, K., "Allgemeine Breve" (Copenhagen 1895). WOLF VON SCHRIEDER, Professor of German Language and Literature.

TEUTONIC RACE. See GERMAN. TEUTONIC ORDER. See GERMANY.

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TEUTONIC ORDER—TEWFIK PASHA

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Tewksbury — Texas

Arkansas, was established in 1877; Saint Rose of Lima Academy is in Texas; Texarkana Industrial College opened in 1904. There are excellent banking facilities and good newspapers. The majority of the inhabitants are American born; about 650 foreign born and 4,200 of negro descent. Pop. (Ark.), 1,898 (1880) 3,528; (1900) 4,914; (Tex.), 1,890, 2,852; (1900) 5,256. Since 1900 the cities have grown considerably and the United States census of 1910 showed the population to be about 9,790; the 1918 estimate is 12,500.

Texas, the most centrally located of the southern tier of the United States, is much the largest of the Union and is popularly known as the "Lone Star State." It is bounded on the southeast by the Gulf of Mexico, on the east by Louisiana, on the east and north by Arkansas, on the north and east by Oklahoma, on the west and north by New Mexico and on the southwest by Mexico. It lies between lat. 25° 51' and 36° 30' N. and between long. 93° 30' and 106° 40' W., and extends, therefore, east and west nearly 800 miles, north and south nearly 750. Its land area is 262,400 square miles and its coast line nearly 440 miles. According to United States census estimates it had a population of 4,700,000 in 1919 and a total wealth of $6,859,909,141 in 1912. Texas is divided into 252 counties and is a political but not a physical geographic unit. The State was admitted into the Union in 1845, having been for 10 years previously an independent republic.

Topography. — The general surface slopes upward fairly uniformly toward the northwest from sea-level to 4,000 feet and more. The Gulf deepens but slowly off shore and long barrier islands enclose along most of the coast shallow lagoons and bays whose total area is about 3,500 square miles. Padre, Galveston and Matagorda islands and Matagorda Peninsula are the longest of these barriers. Dredged channels aided by jetties allow large vessels to enter Galveston and Corpus Christi bays and Sabine Lake. The southeastern and eastern third of the State is quite flat but is diversified by very low hills along its northwestern boundary which rises to 500 feet or 600 feet above sea-level and which is marked toward the south by the Balcones Scarp and toward the north by the White Rock Scarp. The middle third of Texas is mainly level or nearly level country, but is marked by numerous hills which chiefly in the southwest, cluster thickly enough to make large areas of rather rough contour. Except for the Trans-Pecos region west of the Pecos River, the northwestern third of Texas, rising northwesterly from sea-level, is about 2,000 feet on the east to 4,000 feet on the west, is a part of the almost level great plains, but is cut more or less toward the east by the head streams of the larger rivers. West of the Pecos and nearer the Rio Grande, upon a plateau with an altitude of 3,000 to 4,000 feet, rise the Guadalupe, Franklin, Quitman, Davis, Organ, Chinati, Chisos and other mountains. Two peaks considerably exceed 8,000 feet and 18 are higher than any east of the Mississippi. The mean elevation of Texas is 1,700 feet.

Rivera.— As a consequence of the northwesterly rise all the rivers flow in a general southeasterly direction. The Canadian and the Rio Grande, with its tributary, the Pecos, rise
in the Rockies outside Texas. The Red, the Brazos and the Colorado rivers rise on the Staked Plains. The Sabine, the Neches and the Trinity rise in the northeast, the Guadalupe, the San Antonio and the Nueces rise in the central part of the State. The Canadian and the Red rivers are parts of the Mississippi River system. The other rivers discharge into the Gulf along the Texas coast, all except the Brazos emptying into bays which they are siltting up. Owing to slight and irregular rainfall over their upper drainage areas, the larger rivers are not well adapted to navigation, nor do the streams in general afford much constant water power. The Rio Grande divides Texas from Mexico, the Red and Sabine rivers dividing Texas partially from Oklahoma, Arkansas and Louisiana.

Geology.—Archeozoic rocks are represented only in the Llano, Van Horn and El Paso regions where, and in the Marathon region, limited exposure of Cambrian and Ordovician strata are to be found. Scarcely any Silurian and Devonian rocks have been discovered. In north central Texas, Car}-boniferous strata estimated to contain 8,000,000 tons of bituminous coal and a vast quantity of recently discovered petroleum outcrop over an area of 13,500 square miles. West of the coal-bearing area the Permian Red Beds outcrop over 25,000 square miles. The Jura-Trias system is unimportant, outcropping only along the scarps of the Staked Plains. In the Trans-Pecos region are lesser outcrops of the Cretaceous, Permian and Jura-Trias. Exception being made of the Llano region and the Permian-Carboniferous areas, the middle third of Texas from the Rio Grande to the Red River is covered by Upper and Lower Creta- ceous areas in the proportion of two to five. The long Balcones Scarp marks a fault which divides the Upper Cretaceous on the east from the Lower on the west. The Eocene and Pleistocene, separated by a narrow Oligocene and a Miocene-Pliocene strip, occupy all of south central Texas and on the eastern edge of Texas east of the treeless areas. Many of the Basin Range type; basaltic outbursts are to be found widely but sparsely scattered through the southern Upper Cretaceous. In the Llano region vast masses of granite are exposed. Some 20,000,000,000 tons of lignite are estimated to lie in the Eocene Beds. The marine Neocene of the Coastal Plain contains immense petroleum deposits, but petroleum has also been found in large quantities in the Eocene, Cretaceous and even the Carboniferous. Over a thousand square miles of the Eocene are some easily accessible beds of good limonite.

Climate.—The lines of equal rainfall run nearly north and south, the rainfall diminishing from 55 inches in the east to less than 10 inches in the west. The average for the State is 33 inches. Variations from annual averages are common and very wide departures from monthly averages are almost the rule. Evaporation steadily increases from 45 inches at the east to 90 inches at the west. Obviously Texas ranges from humid to arid. Eastern Texas has about 60 per cent of the sunshine. The mean annual temperatures from 55° (35° in winter, 75° in summer) extreme north (Panhandle country) to 76° in winter, 84° in summer) in the extr. Over most of southern and eastern Texas the mean summer temperature is about 81°. Temperatures of 95° are not infrequent, the extremes being 115° and -16°. In winter temperatures at Amarillo and Brown ville differ by 24°, in summer by 9°. H temperatures are much modified by the evaporation and by the Atlantic trade which blow regularly through the area, are frequently interrupted in winter or oppositely directed northerly which blow great violence, sending the temperature sometimes as much as 50° in a few hours. Snow and freezing occur along the coast during the severer northerly and winter day or so. The climate on the lakes is healthful.

Flora.—The large size, varied rain temperatures of Texas unite to produce a variety of plants and animals. A trace of Canadian Life Zone is to be found on of the highest western mountains, lower down by more abundant species of the Transition Zone. The Staked Plateau of north and irregular strip extending to Kerr County, and most of the Trans-Pecos above 4,000 feet are in the Upper Sonoran. The remaining nine-tenths of the State is in the Lower Austral (cotton producing) Zone. The western and larger half of the Lower Austral is Lower Sonoran, the rest is Upper Sonoran. There is a semi-tropical Gulf S. of the Lower Austral as well as arid and arid areas in the Lower Sonoran. Cotton, palmetto, hickory, magnolia, osage orange, sycamore, willow, holly, and loblolly pine abound in eastern Elms, pecans, cottonwoods and willows, the streams with oaks, cedars, hackberry mesquite, etc. In the Texas east of the treeless areas. Many of the cacti, especially the prickly pear, grow in the Lower Sonoran area. Wild flowers abound species and individuals. The various grasses are largely supported by industry.

Fauna.—Prairie dogs, jack-rabbits, ground squirrels, skunks, rats and mice are the commoner animals. The coyote and mule deer, protected by law, are taming their numbers. The wild buffalo and the antelope, bear, panther and puma are nearly as abundant. Armadillos are common south. A great majority of the North American species of birds have been found in Texas. Characteristic and common birds are the Arizona Jay, mockingbird, lark, red bird, meadow lark, swallows, doves, and turkey hawks. The wild turkey is rare. Thirty varieties of lizards and snakes are known. The horned toad is the most interesting native reptile.Monitor lizards and coral snakes and the rattler, black, pilot, coachwhip and many others are widely distributed. There is a variety of fish in the lower coas where small alligators are still fairly common.
2.845 Lockhart........ J 5
750 Lockney........ F 1
5.155 Lone Oak......... L 2
653 Loraine........... G 2
1.071 Lott............. J 8
1.838 Lubbock........ F 1
1.349 Lufkin........... J 3
1.404 Luling............ J 5
1.575 Lyra, Palo Pinto...... J 2
1.864 McGregor......... J 3
4.773 McLean........... C 1
522 McLean............. J 7
657 Mahaffey.......... J 2
1.061 Marble Falls...... J 4
3.875 Martin........... K 3
12.289 Marshall......... M 2
2.839 Mart, McLennan..... J 3
1.849 Memphis........... C 2
1.599 Meredith......... C 7
1.601 Meridian.......... J 3
2.458 Merkel........... J 7
5.270 Mesquite, Dallas..... K 2
2.694 Mesa.............. K 3
2.192 Midland........... E 3
8.485 MILFORD........... K 3
5.750 Mineral Wells...... I 2
1.706 Mineola........... L 2
5.250 Montague.......... J 1
9.644 Moody............. J 3
831 Morgan............. K 3
375 Mount Calm.......... K 3
3.137 Mount Pleasant..... M 1
955 Monday, Knox........ H 1
3.668 Narcodoches....... M 3
1.178 Naples............. M 1
3.384 Navasota.......... L 4
5.750 Nevada............ K 3
2.165 New Iraanfield....... J 5
1.363 Nurena.......... J 1
904 Oakwood........... L
1.081 Odessa............ I 1
5.327 Orange............ N 4
1.037 Paducah........... G 3
509 Paleso............. K 6
1.120 Pageau........... K 2
11.504 Palestine.......... L 3
1.590 Palmer............ K 2
3.210 Panhandle.......... C 2
12.800 Partis........... L 1
1.799 Pearland........... H 6
1.768 Pecos.............. K 3
407 Pecos, Hunt......... K 2
317 Petroleum, Clay.... C 5
1.371 Pilot Point........ I 2
1.916 Pittsburg........ L 2
1.431 Plano.............. L 5
1.258 Plano.............. K 2
7.654 Port Arthur........ K 2
1.899 Port Lavaca......... K 6
1.180 Potterbоро......... K 3
3.127 Quanah............ H 1
348 Queen City........... N 1
375 Quitman, Hunt......... K 2
280 Ravenna, Panhandle... K 1
731 Refugio............. L 5
1.371 Richmond........... L 5
1.986 Rising Star......... J 2
2.073 Rockdale........... J 4
1.361 Rockport........... K 7
1.136 Rockwall......... J 3
1.275 Rogers............. J 4
1.472 Rosebud........... K 3
1.106 Roebberg......... L 5
1.126 Rotan............. G 2
126 Round Top........ E 5
415 Royse City......... K 2
481 Rule................ H 1
1.388 Rusk.............. L 3
1.940 Sabinal........... H 5
1.349 Sabine Pass. M 5
10.331 San Angelo........ G 3
125 San Antonio.......... I 5
1.204 San Augustine........ N 3
834 San Elizario........ B 3
306 San Felipe, Austin... K 3
4.071 San Marcos......... I 6
453 San Saba, Uvalde.... H 5
1.476 Santa Anna........ H 3
328 Sayre.............. K 1
1.081 Schulenburg....... K 5
5.116 Schuler........... J 5
2.027 Seymour.......... H 1
15.667 Sherman.......... K 1
1.098 Siller............. J 5
2.167 Smithville......... J 5
2.514 Snyder............ G 2
1.147 Socorro, El Paso.... H 3
5.902 Stamford.......... H 3
822 St. Jo............. J 1
2.561 Stephenville....... I 3
3.300 Stratford.......... B 1
2.515 Sulphur Springs... L 1
4.176 Sweetwater........ G 2
5.314 Taylor............... J 4
2.588 Teague............. K 3
425 Tehuacana, Lime- stone........ K 3
12.504 Tempe............ J 4
491 Tenaha............. M 3
7.030 Terrell........... K 2
12.010 Texarkana......... N 1
878 Thornton............ K 3
1.528 Timnop............ M 3
797 Times............... K 2
435 Toal................. J 1
288 Tom Bean, Gray- son........ K 1
1.032 Tolly............. D 3
1.126 Troup............. K 2
1.216 Tull............... C 6
1.185 Tyler.............. K 2
5.998 Uvalde............ H 6
288 Union.............. K 4
1.441 Van Alstyne......... K 1
485 Venus.............. K 3
3.193 Vernon............ H 1
3.573 Victoria........... J 5
38.674 Waco............. J 3
1.340 Walnut Springs..... J 3
476 Waterman........... M 3
8.205 Waskashcie.......... K 2
5.074 Weatherford......... J 1
906 Weimar.............. K 4
779 Weimar, Haskell...... H 1
576 Wellington......... D 2
1.645 West, McLennan..... J 3
1.500 Wharton........... K 3
1.219 Whiteboro......... K 1
1.383 Whitney........... K 1
1.986 Whitewright......... J 1
12.224 Wichita Falls...... I 1
1.398 Willis Point......... L 2
1.741 Winnaburg........ K 7
1.347 Winters........... G 3
1.402 Wolfe City......... L 3
898 Wortham............. K 4
620 Wylie.............. R 2
4.657 Yoakum............ J 6
1.180 Yorktown......... J 6
norly Gulf fauna abounds off the coast as a consequence. Very fine fishing is to be found for tarantulas, centipedes and large red insects. A most commonly noticed inversion is that of the sand from the beach.

**Nature and Stock Raising.** — Although a decreasing percentage of the population goes on these industries is still 60 per cent of the male workers. The value of (28,000,000 acres) of the State to crops each year, the remaining 40 per cent of the total furnishing pasture for the beef cattle numbering nearly 450,000 is nearly doubled and the improved range is increased 50 per cent since 1890. Prairie of the Upper Cretaceous is densely populated farming region, but in Red Beds, and the Eocene and the Cretaceous. Large bodies of varicose soil are common. The picture of the landscape is usually colorful and fruitful, with the thousands of contest for the prides of the Texas Industrial College. The census of Texas in about three times the State average in 1910, $962,000,000, or $2,219,000,000. In 1910, has nearly 1900 and has quinquennial since that time. The total value of the annual cotton crop was $200 and 350 millions of dollars, near a sixth of the world's rice production is two-thirds of the total. Values of the cotton, sugar, and tobacco of about 100,000 acres. The production of sugar has decreased, the fruit and the sugar industry. The fruit crop consists of about 200,000,000 pounds, and the value of the cotton crops is about 5,000,000,000 pounds.

The chief crop in Texas is cotton, about equal in the other crops combined and raised. In 1912 the crop is far, 4,820,000 bales, and the value of the annual cotton crop is 200 and 350 millions of dollars, fluctuating about a sixth of the world's rice production. In Texas the acreage irrigated for cotton, 100,000,000 bales. The production of sugar has decreased, the fruit and the sugar industry. The fruit crop consists of about 200,000,000 pounds, and the value of the cotton crops is about 5,000,000,000 pounds.

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**Irrigation.** — Plants fall into two fairly well-marked divisions: (a) numerous small plants widely scattered but chiefly in the west, which use the water from rivers, springs and waterholes to raise a wide variety of crops, and (b) large plants, chiefly the lower parts of the rivers, which irrigate thousands of acres under one management and sell water to individual farmers. In the southeast these large plants are almost exclusively raising cotton. Along the Rio Grande they raise everything but rice. The Elephant Butte Dam on the Rio Grande in New Mexico above El Paso is the only United States reclamation project directly affecting Texas where it will irrigate about 100,000 acres. Perhaps 5,000,000 acres in Texas are irrigable. About a million acres are under ditch and 600,000 acres irrigated annually, half in rice. Most of the water is pumped to the fields, the total capacity of the pumps being over 6,000,000 gallons per minute. Rice irrigation on a large scale is only 15 years old and the average irrigated for other crops has quinquennial since 1900. Farms irrigating for rice numbered 73 in 1900 and 1,088 in 1910; farms irrigating for other crops numbered 1,252 in 1900 and 4,500 in 1910. The most profitable crops in Texas small irrigating plants have existed for centuries. Irrigation development has been particularly rapid since 1910 in the lower Rio Grande Valley but has not been without its setbacks. The recently finished Medina Dam near San Antonio renders 60,000 acres irrigable. Between Hereford and Lubbock lies an area where irrigation water may be obtained from shallow wells. Similar but small areas exist elsewhere. There is an Artesian Belt in South Texas and various wells are sources of water for domestic uses.

**Mining.** — This industry is making great progress. The production of petroleum, which practically began at Corsicana in 1895, owing to the discovery of the first well in 1901 and of other great fields in the succeeding years, has increased immensely but...
has been subject to considerable fluctuations. In the last two years the production of the older coastal and north Texas oil fields has increased and immense quantities of oil have been found in the central carbonate region. Production leaped from 27,644,605 barrels in 1910 to 60,000,000 barrels in 1919. Oil and gas prospecting has been going on vigorously, stimulated by frequent successes. The production of most of the other minerals has had a slow but fairly uniform growth. In 1914 the total mineral production was $30,363,426, including 20,068,184 barrels of petroleum at $14,942,848; 2,247,773 tons of coal and lignite at $3,922,459; 12,433,639 M. cubic feet natural gas at $2,460,770; 2,100,341 barrels of cement at $1,947,016. Clay products, lime, gypsum, cinnabar, salt, sulphur and various other minerals amount to the remaining $7,081,333.

Manufacturing.—Since 1900 the "value added by manufacturing" to the Texas raw products has nearly trebled. In proportion to population, in 1900 Texas manufactured a sixth, in 1915 a fourth, as much as the United States as a whole. Manufacturing has arisen chiefly in response to demands made by the immense raw products, but has been retarded by scarcity of fuel and skilled labor. The major manufacturing industries are naturally based upon the major raw products. The large cotton crop supports nearly 4,000 gins (some very large) and 200 cotton-seed oil mills but only 20 cotton spinning establishments. Flour, grist and rice mills handle the entire crop of cereals but canning and preserving are far behind the opportunities offered by the large fruit and vegetable crops. There are a few large meat packeries slaughtering close to 1,500,000 animals a year. A few large petroleum refineries with a total capacity of 250,000 barrels per day are handling also much Oklahoma and Louisiana oil transported by pipe lines. The lumber area in the east, chiefly southeast, over 50,000 square miles upon which there is an estimated stand of 40,000,000,000 board feet of yellow pine and 20,000,000,000 hardwoods, supports about 400 sawmills and 400 other woodworking plants. About 2,000,000,000 feet of the yellow pine is being cut, but the hardwood cut is scarcely 5 per cent of this amount. The major industries just listed include about two-thirds of the total manufacturing which, in general, is of a kind that involves only simple processes which may be done by machinery.

The manufacture of bricks and other clay products is widely and numerously scattered. Much ice is made in every town. No distilled spirits are made and no wool or mohair is woven. Dallas is second only to Nashville as a Southern publication centre. Dallas and Houston are somewhat ahead of Fort Worth and San Antonio as manufacturing places. The important manufactures of Dallas are cotton gin machinery, meat packing, flour and grist milling, cotton-seed oil and cake, leather and printing. In Houston, meat packing, rice cleaning, railway car repairing and brewing are the chief industries. Fort Worth leads in meat packing and flour milling, San Antonio led in brewing. In these four large cities a third of the total manufacturing is done. Of the wage earners, 6 per cent are women, 2 per cent are children under 16 years.

The 1914 United States census states Texas manufacturing are as follows:

- Number of establishments
- Persons engaged in manufacturing
- Primary horse power
- Capital
- Sales
- Value of finished products
- Value added to raw product by manufacture

Statistics for those industries in value added by manufacture was in $1,000,000 are as follows:

<table>
<thead>
<tr>
<th>Industry</th>
<th>Number of Establishments</th>
<th>Number of Persons</th>
<th>Sales</th>
<th>Value of Finished Products</th>
<th>Value Added to Raw Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lumber products</td>
<td>587</td>
<td>1,188</td>
<td>4,680</td>
<td>63</td>
<td>19,915</td>
</tr>
<tr>
<td>Printing and publishing</td>
<td></td>
<td>1,188</td>
<td>4,680</td>
<td>63</td>
<td>19,915</td>
</tr>
<tr>
<td>Slaughtering and meat pack.</td>
<td></td>
<td>21</td>
<td>3,401</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil, cotton-seed and cake</td>
<td>233</td>
<td></td>
<td>4,711</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lumber, saws</td>
<td>211</td>
<td></td>
<td>4,711</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flour and grit mill products</td>
<td></td>
<td>191</td>
<td>1,300</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foundry and machine shop products</td>
<td></td>
<td>174</td>
<td>3,026</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ice manufactured</td>
<td>253</td>
<td></td>
<td>1,926</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bread and other bakery products</td>
<td></td>
<td>530</td>
<td>1,949</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brick and other clay products</td>
<td></td>
<td>81</td>
<td>1,811</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Cement, confectionery, sheet metal goods, artificial gas, leather and mine are the other chief manufactures; added by manufacture in each case is approximately $1,000,000.

Transportation.—Before the C&St less than 500 miles of railway were 1919 there were over 15,800 miles in not including 4,200 miles of side track way building was greatly promoted by grants until the public lands were in 1882. The leading systems are the Pacific (mileage, 3,000), the Gould Sub including the International and Great and the Texas and Pacific (mileage, 2,000) and the Texas and New Mexico (mileage, 1,500). The Railroad Commission has authority to and otherwise to control intrastate traffic. The issuance of railway bonds is strictly controlled. Texas and New Mexico own the steer half again as much per inhabitant thirds as much per square mile as the States as a whole. Numerous steam connect Galveston with the great world. Some 500 miles of interurban miles of urban electric lines are in From $10,000,000 to $15,000,000 are b each year upon the roads.

Commerce.—Cotton lint is the principal export, exceeding in value all other exports combined. Most of this cotton goes via Houston and Galveston. In order the other chief exports are cotton-seed products, cattle, lumber, mules, rice, wool and mohair. The chief machinery, clothing, vehicles, and a wide variety of other manufactured goods. Pork, sugar, potatoes and other foodstuffs are imported in considerable amounts. Strong efforts are being made to reduce such food importations by increasing the amount of crops which can reduce such food importations by consumption about balance, cotton
1 The Alamo, San Antonio, built in 1718

2 The Mission San José, near San Antonio, built in 1718
from the count. This lint produces a
of of trade in favor of Texas of over
0,000 a year. Galveston is one of the
principal ports of the world; her imports
ports are mostly but not exclusively of
duty-free, and originate mainly in the

Banking.—Law and public opin-
ning governmental banks, private banks,
of which are still flourishing, prevailed
865 when the first national bank was
red at Galveston. In 1918 there were 12
banks at Dallas. The total capitaliza-
tion of these banks is above $35,000,000; the
surplus is above $20,000,000; the total de-
are over $200,000,000. A State bank
went into effect in 1905 under which 900 State banks have gone into successful
on. Their total capitalization is over
1,000, their surplus is over $12,000,000,
postits are about $105,000,000. De-
are protected either by a binding sys-
by a State guaranty fund maintained
ments on the banks collectively. Ten
ul banks have deposits in excess of $4,
1 each; 10 State banks have deposits of
1,000,000. Each of these banks, known as
preponderant bank. Interest rates are
other high, kept up by rapidly rising land
large business profits and by other
government.—The present constitution
2 in 1876 and has not been extensively
ed since. The chief elective officials are
vernor, attorney-general, treasurer, com-
er of the general land office, superin-
t of public instruction and commissioner
ructure, together with three railroad
ssioners. The chief officials appointed by
vernor are the secretary of state, adjun-
geral, three penitentiary commissioners
 other officers whose duties relate to
ce and banking, taxes, revenues, public
State purchasing, game, public buildings,
ines, pure foods, reclamation of lands,
s, fires and masonry inspection. The
ry is elective. In ascending order there
ate and Municipal Courts, County Courts,
t Courts, each with one judge or presid-
cial. Above these are nine Courts of
peals above which are the Court of
al Appeals and the Supreme Court.
of these higher courts has three judges
 in rotation every two years for six-
. The legislature meets biennially
of a senate of 31 members elected
ly every two years for four-year terms
ouse of 142 members elected for two-
rs. There have been numerous called
. The State is divided into 41 United
judicial districts and into 16 Congress-
Of the 18 congressmen two are there-
elected at large. Voting is restricted to
21 who have paid the poll tax and
ed one year in the State and the last
months in the district in which they live or
is to be done. The old convention
of selecting officials has been largely
ed by the general primary. The salaries
officials are not large. The govern-
ment of Texas, however, is on a scale that is usual
other States and he controls a consider-
mount of patronage. He appoints nearly
40 State boards and a two-thirds vote of both
house and senate is required to overcome his
vetto. In general the county is the local unit
of government. Spanish influence has caused
some civil law to be incorporated into the
common law. Law and equity are not dif-
erentiated, common-law forms of pleading
have been abolished, and a Penal Code and a
Code of Criminal Procedure dates from 1856.
Texas has been the pioneer in adopting the
community property system in exempting the
homestead from liens, in the commission form
of city government, in the regulation of rail-
way stock and bonds, in the regulation of farm
tenant rents.
State Finances.—In 1915 the total assessed
valuation was $2,755,171,793, upon which was
levied a total State ad valorem tax of 55 cents
on the $100. This tax, together with charter
fees, poll and occupation taxes, etc., produced a
total revenue from taxation of about $13,240,
000. To this should be added $2,140,170 aris-
ing from the State Permanent School Fund of
nearly $68,000,000. The university and the
Agricultural and Mechanical
College possess endowments derived, like the
Permanent School Fund, from the sale of
State lands set apart for the schools in early
days, which yielded an income of about $260,
000. Expenditures were as follows: State de-
partments, $1,633,505; judiciary, $1,057,197;
eleromosynary institutions, $2,863,876; Con-
ederate pensions and homes, $1,558,171; mis-
cellaneous, $262,821; higher education, $1,754,
077; public schools, $7,999,059. Income and ex-
penditures are increasing at least 3 per cent a
year. Of the ad valorem tax of 55 cents, five
cents is specifically set aside for Confederate
pensions, 20 cents for the public schools. The
State debt is negligible, but the total debt of the
 COUNTIES exceeds $30,000,000; of the cities it
is about $60,000,000. County tax rates are
 general under $1 on $100 but in some cases the
city rates reach $2.
Education.—To the $7,999,059 spent by the
State on the public schools in 1915 should be
added $6,387,866 raised by local taxation in counties,
districts and cities and $518,628 derived from
local sources. Per Pupil School Funds, similar to the State Permanent
Fund, and amounting to nearly $13,000,000. On
about 1,100,000 children of free school age
Texas spent in 1915 about $14 per child. There
are nearly 25,000 teachers, of whom scarcely
1,500 hold college degrees, of whom about 3,000
hold certificates that would admit to normal
 colleges. The rural schools are open scarcely
six months per year. There is such pressing
need of improving rural education that the
legislature of 1915 appropriated $1,000,000 for
the purpose and it is probable that this amount
will be increased in future. A compulsory
law now going into effect will cause a much needed
improvement in attendance. The high schools,
between 500 and 750 in number, are of very un-
equal merit but are improving fairly rapidly.
The training and the salaries of teachers are
increasing. The value of the public school
buildings exceeds $30,000,000. Receipts from
sales of school building bonds were $2,847,591
in 1913, the amount collected by local taxation
for redemption and interest on bonds was
$1,719,682. There are numerous private second-
ary schools. The native white illiteracy was 6.1 per cent. in 1900. 4.3 per cent in 1910; of negro illiteracy 24.6 per cent in 1910, 85.6 per cent in 1900.

The State normals at Huntsville, Denton, San Marcos, Canyon City, Commerce and Alpine for whites and at Prairie View for negroes. The Girls' Industrial College is at Denton, the Agricultural and Mechanical College (which has income from the United States and from other sources not enumerated above) boys at Bryan, the University of Texas is at Austin with the exception of the medical department which is at Galveston and a school of mines at El Paso. These State higher schools, whose total enrollment, regular session, exceeds 8,000 are almost wholly supported by biennial legislative appropriations. There are nearly 50 private and denominational colleges of various grades, with an attendance in excess of 14,000.

Charities and Corrections.—Three insane asylums, with a total of 4,000 inmates, are located at Terrell, Austin and San Antonio. There is an epileptic colony at Abilene; a blind institute, a deaf, dumb and blind institute for negroes, a deaf and dumb institute, a Confederate home, a woman's Confederate home and a farm colony for feeble-minded are at Austin; an orphan's home is at Corsicana; a juvenile training school for boys is at Gatesville and for girls at Gainesville; a tuberculosis sanitarium is at Carlsbad. In addition to these State-maintained institutions there are numerous denominational and private hospitals and retreats of various kinds. The State penitentiaries, containing usually from 4,000 to 5,000 inmates, are at Rusk and at Huntsville, and, mainly through farming, are designed to be self-supporting, but have in recent years created large deficits.

Religion.—Accurate recent statistics do not exist. The best approximations are as follows: Baptists, 490,000; Catholics, 375,000; Methodists, 375,000; Presbyterians, 85,000; Disciples of Christ, 60,000; Lutherns, 35,000; Protestant Episcopalians, 20,000; Jewish, 15,000; all other denominations, 45,000. Most of the negroes are either Baptists or Methodists. Other approximate church statistics are as follows: ambuches, 9,500; church organizations, 12,500; Sunday-school teachers, 65,000; Sunday-school pupils, 600,000; value of church property, $27,000,000; seating capacity of the churches, 3,000,000; church debts, $1,350,000. The Y. M. C. A. and Y. W. C. A. hold property worth $1,700,000.

Population.—The first United States census taken was that of 1850 when the population was 212,592. In 1870 the population was 818,579; in 1890 it was 2,255,523; in 1910 it was 3,823,471. The rate of increase was about 85,000 a year. Native white Americans form 73 per cent of the population. 51 of this 73 being native white Texans. Foreign born Europeans number 3 per cent, Mexicans 7 per cent, negroes 17.7 per cent (20.4 per cent in 1900). A large German element in the population of South Texas dates from 1846. General Texas is Southern in type and Southern in habits and of the West. The occupation percentages for the male workers (who number about 1,330,000 in 1915) are: Agriculture and stock raising 60 per cent; manufacturing and mining, 14 per cent; trade and transportation, 15 per cent; professions, 3 per cent; all other occupations 8 per cent. White farm tenantry and the percentage of women at work are increasing. The towns are increasing much faster than the country, 68 per cent as compared with 19 per cent during the last census decade. The five largest cities increased 107 per cent. Only 19 per cent of the people live in towns of more than 10,000 population. Sixty-six per cent of the population is rural. According to the estimates of the Southern M. S. Institute University at Dallas and the Rice Institute (endowment over $10,000,000) at Houston, together with the much older Baylor University (Baptist) at Waco, Southwestern University (Methodist) at Waco, Texas Christian University at Fort Worth, have passed 100,000. El Paso is near 50,000 and Galveston 40,000; Austin, Waco and Beaumont have passed or are nearing 20,000. Between 10,000 and 20,000 are San Angelo, Parmer, Brownsville, San Angelo, Paris, Texarkana, Caddo, Palestine, Tyler, Wichita Falls, Corsicana, Castor, Christ and Greenville.

History.—The first explorers were Spaniards, Cabeza de Vaca, 1528-36, and Francisco Vasquez de Coronado, 1540-42. Other Spanish gold hunters traversed the State occasionally during the next 140 years but it was not till 1662 that a still-existing Indian pueblo under Spanish auspices was found at Ysleta near modern El Paso, 200 years younger. La Salle, driven west by a storm while searching for the mouth of the Mississippi down which he had sailed, three years previously, built in 1685 near Matagorda Bay, a fort which was soon destroyed by the Indians. Four Frenchmen found refuge among the more peaceful Tejas Indians who, as a result, have the tribal name perpetuated as "Texas." Alarmed by this accidental and unexpected invasion, the Spaniards of Mexico established in 1690 the Mission San Francisco de los Tejas, near modern Nacogdoches, but this far-away mission was soon abandoned. Later various other scattered missions and forts were established, but in 1800 those at San Antonio, Nacogdoches and Goliad were the chief results of over 200 years of Spanish colonization. San Antonio, begun in 1718, became in 1730 the first civil European settlement in Texas. The first civil European settlement in Texas begins in 1821. The Spaniards having failed to settle the country, three abortive invasions between 1800 and 1821 by Anglo-Americans were shadows of coming events. In 1821 Mexico, finished successfully her war of independence begun with Spain in 1810; in 1821 the United States gave up a claim to Texas arising from the purchase of Louisiana from France in 1803; in 1821 Moses Austin obtained permission to locate 300 American families but, dying, his son Stephen de in March 1830 established the beginning of an American settlement at San Felipe de Austin on the lower Brazos River in December 1822. During the next 15 years probably 30,000
TENNESSEANS came to Texas, settling mainly along the coast between San Antonio and Nacogdoches. They came, not because, as has sometimes been alleged without evidence, they specifically to extend the slave-holding area. For real Mexican, they practically governed themselves and formed no close or ties with their adopted country. A Mexican republic resulting in 1824, and Coahuila became one state divided the departments of Saltillo, Monclova and Revolucion and disorder prevailing in Mexico, when Santa Anna established here a dictatorship in 1835, the American the declaration of a provisional government in favor of a union with the radicals together with a restoration of Mexican independence in 1836 and 1845 Texas was independent republic, a unique experience of the States of the Union. In 1845, Texas was an ally of the United States, retaining all her lands and the right to subdivide into five States. Claims to a portion of Mexico were abandoned later for which were used to pay the debt to Mexico had accumulated. The annexation of Texas brought on the war between the United States and Mexico which was Rio Grande an international boundary. In 1874, Texas was not the scene of any military operations; Federal troops attacked the public and spread further. In 1884, the control of the usual type of constitutional government was not completed until 1874 when Gov. E. J. Davis was removed from office.

1874 Texas has been Democratic by majorities. The carpet bag constitution was replaced in 1876 by the constitution in force. In 1874 the Texas Ranger State was organized to protect the frontier from Indians. The debt of the Texas administration was paid during the civil war. Coke Hubbard and Roberts handled the matter of rapid spread of barbed wire and the rapid spread of barbed wire. The old Capitol burned down in 1881. The most important studies in civil was the day that in 1892 when Governor fought and won a hotly-contested election in which resulted in the establishment of a strong commission with large powers and a strong commission with large powers and arrested the alien ownership of land. Prohibition, first voted on in a State election in 1887, has since been a much-fought issue. At present all of the people live under well-enforced local option laws. In 1896 the United States Supreme Court ruled finally the laws of Texas by awarding Greer County in the forks of the Red River to what is now Oklahoma. Texas from time to time has suffered from river floods and from tropical storms along the coast. At Galveston in 1900 thousands of lives and much property were lost in a storm. Out of this calamity grew the Galveston Sea Wall and the commission form of government. The supremacy of the Democratic party, threatened for a few years by Populism before the Democrats adopted free silver in 1896, shows no signs of failure. The political problems now before Texas are the development of a more efficient system of public schools, the reduction of farm tenantry, compulsory investment of life insurance funds in Texas securities, abolition of the fee system of paying county officials, penitentiary reform, reforms in legal procedure and better public roads.

PRESIDENTS OF THE REPUBLIC

- David G. Burnet, ad interim 1836
- Sam Houston 1836-38
- Mirabeau B. Lamar 1838-41
- Sam Houston 1841-44
- Anson Jones 1844-46

GOVERNORS OF THE STATE

- J. Pinckney Henderson, Democrat 1846-47
- George T. Wood 1847-49
- P. Hansborough Bell 1849-53
- James W. Henderson (acting) 1853
- Eliza M. Pease 1853-57
- Hardin R. Runnels 1857-59
- Sam Houston, Independent and Unionist 1859-61
- Edward Clark (acting) 1861
- Francis R. Lubbock 1861-63
- Pendleton Murrah 1863-65
- Intergovernment 1865
- Andrew J. Hamilton, Prov., appointed 1865-66
- James W. Throckmorton, appointed 1866-67
- Eliza M. Pease 1867-70
- Intergovernment 1867-70
- Edmund J. Davis, Republican 1870-74
- Richard Coke 1874-76
- Richard B. Hubbard 1876-77
- Oren M. Roberts 1877-79
- John Ireland 1879-83
- Lawrence B. Ross 1883-87
- James S. Hogg 1887-95
- Charles A. Culberson 1895-99
- Joseph D. Sayers 1899-1903
- S. W. T. Lanham 1903-07
- Thomas M. Campbell 1907-11
- Oscar B. Colquitt 1911-15
- James E. Ferguson 1915-17
- William P. Hobby 1917-

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TEXAS — TEXAS CHRISTIAN UNIVERSITY

vy and Bureau of Economic Geology; Annual Report United States Geological Survey; North American Fauna 25, United States Department of Agriculture.

H. Y. BENEDICT, Dean, University of Texas.

TEXAS, The University of, the head of the public school system of the State, is located at Austin, except the medical department at Galveston and a loosely connected school of mines at El Paso. The first step toward its establishment was taken in 1839 when the Congress of the republic set aside 40 acres for a campus in the future city of Austin and 50 leagues of public land as an endowment. In 1858 the legislature increased the endowment by adding $100,000 of United States bonds and lands amounting to 10 per cent of all the public lands granted to railroads. The constitution of 1876 replaced this 10 per cent by 1,000,000 acres, to which the legislature added another 1,000,000 in 1883. The university was finally organized in 1881, located by a popular vote and opened to students in 1883. Since that time the Agricultural and Mechanical College had been opened and although vaguely made a branch of the university by the constitution of 1876, has existed separately under its own board of directors. From its 2,000,000 acres, which are in West Texas and leased to cattlemen, the university has an income of nearly $170,000; fees and interest on $60,000 derived chiefly from land sales amount to about $50,000 more. The annual appropriation for running expenses from the legislature for 1919-20 is $950,000. The constitution prohibits the use of legislative appropriations to pay for buildings, and the act establishing the university limits the matriculation fee to $30, admits men and women on equal terms and prohibits any sectarian instruction or religious tests for officers or students. The government is in the control of a board of nine recents appointed by the governor with the consent of the senate, three every two years for terms of six years. The departments of the university are (1) the college of arts, (2) the department of law, (3) the department of engineering, (4) the department of medicine, including pharmacy and nursing, (5) the department of education, (6) the agricultural department, (7) the summer school and normal school, (8) the department of extension, (9) the bureau of economic geology and technology. The B.A., B.S., M.A., Ph.D., L.L.B., L.L.M., C.E., E.E., M.E., and M.D. degrees are conferred. Provision is made for taking the B.A. and L.L.B. in seven years, the B.A in four years. Twelve courses, somewhat elective under a system of grouped studies, are required for the B.A. Fourteen and one-half years of high school must be completed for admission. Additionally the department of law requires a minimum of 30 college courses, the medical department also requiring 30. The L.L.B. requires three years, the M.D. four years of nine months each. The summer school offers during the summer session of three months as many as possible of the courses of the regular session. In addition to the older collegiate subjects, courses in journalism, home economics, business administration, music and art are offered. The usual college clubs, fraternities, associations, fellowships and scholarships abound, and an unusually broad system of student government prevails, accompanied by the honor system on examinations. The campus at Austin is surrounded by churches and an association of religious teachers give courses which are allowed to count toward the B.A. At Austin are the Main, Law and Engineering buildings, the library, two dormitories, a power house, a chemical laboratory and about 25 small cheap frame buildings which growth has necessitated and which are used for various purposes. At Galveston are the Medical College building, the five buildings of the John Sealy Hospital, a dormitory for women and a course of home study. The library has over 150,000 bound volumes, including a number of rare first editions. The laboratories are well equipped. There are various funds, mostly small, and numerous special collections. During the regular session of 1915-16, 3,100 students were in attendance. An addition 500 other individuals were in the summer school, 500 in the summer normal and 700 doing correspondence work. The attendance has more than doubled since 1909. The regular faculty numbered 180 in 1916-17 and 350, the affiliated high schools nearly 300. Most of the Texas colleges officially use the affiliated list of the university.

TEXAS AGRICULTURAL AND MECHANICAL COLLEGE, located at College Station, Brazos County, Tex. It was established in 1871, receiving as an endowment 180,000 acres of land from the National government, in accordance with the Morrill Land Grant Act of 1862. Opened for the reception of students 4 Oct. 1876. The government of the college is vested in a board of nine directors, appointed by the governor for terms of six years. It offers 11 four-year courses leading to the degree of B.S., as follows: Agriculture, architecture, architectural engineering, chemical engineering, civil engineering, electrical engineering, general engineering, mechanical engineering, military engineering, textile engineering. A four-year course in veterinary medicine leading to the degree of D.V.M. is also offered. Two-year courses in agriculture and engineering are provided for students with limited preparation, who are over 18 years of age. Graduate work in agriculture and engineering is also provided. The college farm and grounds, covering 300 acres, of which 750 are under cultivation; the grounds and buildings in 1916 were valued at $2,000,000: in 1915 and 1916 buildings to the value of $375,000 were erected, including a hospital, an assembly hall, a veterinary building, a stock judging pavilion and a steam plant. The library in 1916 contained 25,000 volumes; the enrolment for 1915-16 was 1,415, the faculty 103.

TEXAS BLUEGRASS. See GRASSES IN THE UNITED STATES.

TEXAS CHRISTIAN UNIVERSITY, located at Fort Worth, Tex. It was founded in 1854, as a private institution in Thorp Springs, Tex., in 1875, and chartered under the name of the A.D. College in 1890 the college became the property of the Christian Church of Texas, and in 1895 was moved to Waco, Tex., and the name was changed to Texas Christian University. In the spring of 1910 the college was burned at Waco, and it was moved to Fort...
TEXAS FEVER — TEXTILE INDUSTRY

Tex., that year, where it opened in of 1910. The university now includes owing departments: (1) The Add Ran of Arts and Sciences; (2) the College Bible; (3) the College of Business; (4) legs of Music; (5) the School of Ora-

3) the School of Art; (7) the Prepara-

hool; (8) the department of domestic ; (9) the department of law ; and (10) lege of Medicine, located at Fort Worth.
The university is coeducational and is ol of the Disciples of Christ in Texas; et societies are permitted but the su-

maintain four literary societies and an association besides other art and rel-

cieties. The campus contains 50 acres ground around the city. The buildings the Girls’ Home (Jarvis Hall); Worth lark Hall, Goode Hall, Brite College and College. The income is about yearly; the library contains over 12,000

; and is a government depository; the in all departments, in 1915-16 num-

10 and the faculty 78.

KAS FEVER, in cattle. See RINDER-

COCO, tās-kōkō. See TEZUCO.

ÆL, tēk-sēl, Netherlands, an island, est in the West Frisian group that s Zuyder Zee from the North Sea. epaulets from North Holland by the of Mars-Diep. Its area contains about 16 miles, mostly fertile lands, which the pastureage and fields for the growing s. Stupendous dikes protect the island. aisering is the chief industry, and the d cheese are noted products. Texel has esting war record. It was here that the ed victory of Admiral Blake was won e Dutch in 1653. Another important as fought (1633) between united France lland against Holland. In 1797 the s blockaded, and the Dutch fleet sur-

d to Admiral Mitchell in 1799. Pop. 500.

IER, tēs-yā, Charles Félix Marie, traveler and archeologist: b. Versailles, 29 Aug. 1802; d. Paris, 1 July 1871. yrks comprise ‘Description de l’Asie ?’ (1839-48) and ‘Description de jie, de la Perse, et de la Mésopotamie’ 5).

TIE AND ORAL TEACHING.

ICATION, ELEMENTARY.

TEXTILE DESIGNING. This term is r the designing of textiles in which the is obtained in the weaving and not by ent printing. The simplest patterns are ses and checks. By running 5 or 10 ts and 5 or 10 gray threads alter-

n the warp, stripes would be made. If e thing was done also with the weft or a checkered pattern would result. In ng a pattern the designer first considers ght of cloth desired and calculates what thread or “yarn” he needs and how t threads there will be to the inch. He bases his design on the inch. Having mae knowledge of the loom harness, determines the arrangement of the or “weave,” he knows its limitations t what combinations are practicable. If

he uses a plain weave, in which the threads interlace alternately, it is very easy to design checks and plaids. He may decide to use the twill, in which the shuttle carries the woof-threads over one and under two or more warp-threads. By carrying this twill principle a little further, he may produce a diagonal cloth. If he is dealing with silk, and wants a glossy surface, he may decide on a satin weave, which reduces the number of crossings of warp and weft, permitting a close texture and a glossy finish on one side. Some successful designs de-

fine largely the stability of the cloth, for users judge a fabric mainly by the effect at first sight. The patterns must be harmonious or with artistic contrasts to please the various tastes. To sell at certain prices, they must have definite weights per yard, as buyers of large quantities will require 10, 12, 14, etc., ounces to the yard. The designing of silk, linen, wool and other fabrics involves many differences, which must be thoroughly under-

stood. And carpet and rug designing is a different business, requiring complete knowl-

edge of their manufacture. The designers of rugs try to imitate the higher priced hand-made rugs from the Orient, and often succeed admirably. Consult Beaumou, “Colonial in Woven Design” (new ed., 1912). See WEAVING.

TEXTILE INDUSTRY. American.— In 1800 there were no textile mills, as the term is now understood, in the United States. Whatever the American people did in the way of manufacturing their own clothing was mostly done in the household; the spinning wheel and the handloom were utensils as familiar in the old-fashioned kitchens as the pots and kettles of the housewife. The homespun garments worn by our forefathers were fashioned out of wool grown on the home farm, carded by hand,

ards, washed in tubs, spun and woven by hand, fulled and finished at home, cut up and sewed — all by the joint labor of husband, wife, sons and daughters. The finer clothes worn in those days were all imported; and as the colonies grew and multiplied, and the cheapness of English textiles increased, the manufacturers of the mother-country foresaw a wondrous new market opening up before them. The desire to retain and increase that market for textiles, in the manufacture of which England already led the world, was far more prominent among the causes leading up to the American Revo-

tion than its historians have yet discovered.

Colonial Homespun.— The homespun garments of colonial days were plain, and wore like iron; their ingredients were indicated in the name commonly applied to the cloth — “linsey woolsey.” It was a fabric of woolen weft, woven on a linen warp. Linen was much more commonly produced in the household than cotton fabrics, and wool was more in use than all other fibres combined. Cotton was a scarce commodity in Colonial America until long after the Revolution. It possessed a value equal to that of wool, and sometimes very much higher. What little of it was used prior to the 19th century was mostly imported from Barbados. When Samuel Slater started the first American cotton mill at Pawtucket, in 1793, he insisted upon using cotton from the Indies, because of the poor quality of the cotton then raised at home. No one dreamed, when the “Shipping
TEXTILE INDUSTRY

and Commercial List and New York Price Current first made its appearance, that America was destined to become the cotton-producing country of the world; nor did Slater's little mill of 250 spindles, which had then been in operation five years, give signs that it was the germ of an American industry which would consume annually within 100 years more cotton than all the world was then growing. The history of the textile industries during the colonial period, as recorded in tabular form, to a large extent, the development which confronts and amazes the student at the opening of the 20th century, who finds them, with their subsidiary industries, employing more capital and creating a greater value of annual product than any other group, except iron and steel.

Expedients of the Colonists.—Our forefathers realized how important it was that the colonists should learn to clothe themselves. They resorted to all sorts of expedients, some of which were state socialism to overcome the difficulties in the way. They offered bounties to increase the number of sheep and promote the growth of flax. In Massachusetts laws were passed making it compulsorily, to each family, a certain quantity of yarn every year, under penalties of heavy fines. Gradually the household textile industries assumed an importance which alarmed the mother-country, and the Lords of Trade attempted, by various restrictive orders to prevent and harass a development which threatened to destroy the colonial market for the chief products of British industry. Parliament passed an act in 1774 — which was shortly after the Arkwright inventions had inaugurated the modern factory system — forbidding the exportation, under heavy penalties, of any of the machines used in the cotton, silk, woolen or linen manufacture. This statute, which remained in force, with certain modifications, until 1845, was evidence of a puerile hope that the English people could keep the fruits of inventive genius bottled up in their little island, while England permitted her sons to carry their inventive ideas across the water.

First Woolen Factory.—Slater brought here, by the use of power-driven machinery, in the same way Arthur Schofield, three years later, invented the first wool-carding machine, which he built and put into operation at Bifield, Mass., in 1794, thus fixing the date of the beginning of the factory manufacture of wool by machinery operated by power in the United States. American machinists and inventors did the rest. It is not to be denied, however, that the English statute did regard, embarrass and make trebly difficult the early development of our textile factories.

Steps of Evolution.—It would be interesting to follow the evolution of the household industries by slow and gradual steps, into the highly developed ones of today. First came the neighborhood fulling-mill utilizing the friendly services of the adjacent stream, and relaying the housewife of the labor of tulline and finishing the clothes and blankets according to the last during the long winter months. Then the carding-machine was added to the fulling-mill; the farmers for miles about brought their wool to be converted rolls ready for the spinning-wheel. If Slater had successfully applied the Arkwright invention to the spinning of cotton a few years later, the woolen mills gradually appeared which spun both wool and linen by water power. Hosiery were still used in all these mills 1813, when the invention of a power-loom by Francis C. Lowell led to the building of his Waltham cotton factory by the Boston Manufacturing Company, and the American mill first took on the characteristics which since increasing distinguished it. Power and weaving machines were rapidly applied to the manufacture of woolens, and it can be seen that the household manufacture of textiles was disappearing before the general economy and efficiency of the factory system. The transition was not rapid, and the upswings of our first textile mills were numerous and discouraging.

War of 1812.—The outbreak of the War of 1812, and the non-intercourse acts and embargoes which preceded it, were the most potent factors in completing the transition. The total restriction of imports spun a golden web upon their own resources for their entire clothing. Cotton and woolen mills, quickly built. High prices and the promise of quick fortunes drew many men with little knowledge of manufacturing into the labor. All went well enough until the war ended; a fallowed collapse and ruin. The work of building the solid foundations of textile manufacture had all to be done over again. Improved and woolens again invaded the market; a rush, and the domestic manufacturers felt it impossible to compete with them either quality or in price. Labor was unskilled and cheap; knowledge and experience sadly wanting; machinery was clumsy and inefficient; the country was poverty-striken, trade, and the national finances more demoralized.

First Protective Tariff.—Then first was the great battle in Congress, by which was made more or less intermittently ever since, for the protection of the domestic industries by means of tariff laws. The Tariff Act of 1816 — the first of the series in which the principle of protection was recognized in the rates as a distinct purpose of the law, conjointly with the raising of revenue — was much more favorable to the cotton than to the wool manufacture, because it applied the minimum prior to cotton cloths, which was in effect a duty of 6½ cents a yard, while the simple valorem rate of 25 per cent was applied on woolen goods. From the date of the law the cotton manufacture began a healthy development, and it naturally grew much faster than the wool manufacture. The later were much more delicate, complicated, and exacting in their methods and operations. The Tariff law of 1816 was like a rule, more favorable to cotton than to woolens; partly owing to the fact that cotton was a more rapidly growing industry, and to the fact that the woolen manufacture has at all times except during the Civil War shown a greater prosperity than the whole a more rapid development than the sister industry. But in both industries many years it was an up-hill struggle.
TEXTILE INDUSTRY

Few fortunes were made; many, and the courage and tenacity of those textile manufacturers deserve to be remembered.

1850.—In the last half of the 19th century, there was an increase in the value of about six times, and not less than if it were possible to measure this quantity instead of by value. Even so, figures would not be so numerous that they have completely transformed the modus operandi of textile mills throughout the world. These mechanisms are more generally used to-day in the best American textile mills than in those of any other country. So far as mechanical equipment is concerned, our best mills, whether cotton or woolen, are fairly equal to the best in any foreign country. It does not follow that textile manufacturing is done here, as a rule, with equal economy in cost.

Mills and Equipments.—In structural equipment the modern American mill is in some respects superior to the average foreign mill. It is not so massive a structure, nor so solidly built, brick being used here, while the English generally use stone; but in the lightness and airiness of its rooms, in economy of arrangement and in general completeness of equipment and care for the comfort and convenience of the operatives, it is usually superior. The lesson is fast being learned by our textile manufacturers that in these days of close competition and small profits successful manufacturing requires that buildings shall be of the latest design and the most approved management, and that machinery shall not only be modern in design, but made in the most perfect condition by constant renewal. Many parts of the machinery required for the equipment of our textile mills are still necessarily imported from England, because not made, or less perfectly made, in the United States. Our machine manufacturers have been advancing as rapidly in recent years as the textile mills themselves, and the time cannot now be far distant when every new mill built in America will be equipped throughout with American-made machinery. The United States shows a firm grip and exports have reached beyond the million dollar mark. Textile machinery in 1914 was being made in 241 establishments valued at $30,437,689. In that year machinery was exported to the value of $13,083,048.

Variety of Fabrics.—The American textile mills now supply practically every variety of fabric made in the world, with the exception of linens and the very finest grades of other fabrics. Great sums of money have from time to time been invested by daring manufacturers in constructing plants for the manufacture of linen fabrics. The result has often been disappointment and failure. These obstacles are still formidable, but the flax being a fibre which requires more moisture than any other for its successful manipulation. Again, there is difficulty in obtaining a home supply of suitable raw material. Years of high protection have failed to persuade the American farmer into growing flax for fibre. The history of the linen manufacture in other countries seems to establish the fact that it is the one textile manufacture likely to remain segregated in a few

had ever been woven by power looms in any country until it was done by George Crompton at the Middlesex Mills in 1840. Every carpet ever woven was woven by hand. In 1785, Erastus Brigham Bigelow revolutionized the industry. Beyond these fundamental machines the American mechanisms for expediting processes, for automatic devices, for dispensing with intermediate help, have been so numerous that they have completely transformed the modus operandi of textile mills throughout the world. These mechanisms are more generally used in the best American textile mills than in those of any other country. So far as mechanical equipment is concerned, our best mills, whether cotton or woolen, are fairly equal to the best in any foreign country. It does not follow that textile manufacturing is done here, as a rule, with equal economy in cost.
localities like Holland and Ireland, where the fibre is grown on the spot, where the climate is peculiarly adapted and where the help has acquired an experient born of generations of experience. Moreover, the one textile the consumption of which has not appreciably increased with the growing perfection of textile machinery. The other fibres, less difficult to handle, more susceptible to cheap manipulation, continually encroach upon its territory.

Silk Industry. Perhaps the most striking contrast to our experience with linen is that afforded by the silk manufacture. At first sight it would appear that this must be the particular textile industry which could not flourish in America. Since last century’s whirm of the speculative mania to cultivate the silkworm which swept New England in the thirties, and wrecked the fortunes of many too credulous farmers, we have settled down to the conviction that America cannot grow the silk to compete with China, Japan and Italy. Moreover, the silk manufacture, like the linen, has always been highly specialized and localized. The city of Lyons, in France, had well-nigh monopolized the manufacture, so far as it had escaped from the hand processes of the Eastern grain dress silks was then started, and at present time brocaded silks and satins manufactured on a large scale; indeed is no form of fabric into which silk is not now produced in great quantities. Especially noteworthy has been the development in the manufacture of silk and all varieties of upholstery goods. The of home-made silk goods was in 1880 just as equal to the foreign value of the goods shipped. In 1890 the production had grown so much that it was nearly double the value of the imports and more than double the value of the produce in 1830. During the next decade the rate of increase was accelerated. In Paterson is est silk-ribbon mill in the world. And in that city, an outgrowth of the little patented by John Ryle, covers an acre and a half and can nowhere be surpassed for size or completeness of equipment. See Silk and S Industry (History of the Industry in United States).

The consumption of raw silk in recent years is as follows (in pounds): 1914, 24,023; 1909, 17,290; 1904, 11,572; 1900, 8,705. Statistics of the silk industry are as follows:

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<th>Establishments</th>
<th>Wages-earners</th>
<th>Capital</th>
<th>Wages</th>
<th>Cost of material</th>
<th>Value of produce</th>
</tr>
</thead>
<tbody>
<tr>
<td>1914</td>
<td>902</td>
<td>108,170</td>
<td>$210,072,000</td>
<td>$47,109,000</td>
<td>$144,442,000</td>
</tr>
<tr>
<td>1900</td>
<td>852</td>
<td>99,017</td>
<td>152,158,000</td>
<td>88,570,000</td>
<td>106,912,000</td>
</tr>
</tbody>
</table>

Other important statistics in the silk industry are the following: Amounts of spindles in Throwing (raw silk) in 1914, 677,900; 1904, 637,585; 1903, 624,680; 1909, 442,410; Spinning and Twisting in 1914, 2,023,391; 1909, 1,675; Spinning of Span Silk in 1914, 107,251; 1904, 130,547. Thrown and spun silk in 1909 amounted respectively to $1,394,032 and $1,213,493.

Cotton. In the textile industry King Cotton still maintains supremacy. And the United States holds a proud position among her low-nations. The industry has shown marvelous growth in the last quarter of a century, but the centres of production have shown a frequent reduction of output in individual mills while collectively the admirable increases. The first cotton mills were in New England but by 1860 the industry had spread into scattered sections shown by the following table which gives England 52 per cent of establishments and 37 per cent of spindles.

<table>
<thead>
<tr>
<th>Establishments</th>
<th>Spindles</th>
<th>Cotton Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>New England, 1,547</td>
<td>291,100,000</td>
<td>9,100,000</td>
</tr>
<tr>
<td>Middle States, 840</td>
<td>87,100,000</td>
<td>1,000,000</td>
</tr>
<tr>
<td>South, 139</td>
<td>44,900,000</td>
<td>300,000</td>
</tr>
<tr>
<td>West, 22</td>
<td>25,000,000</td>
<td>40,000</td>
</tr>
</tbody>
</table>

In this industry, for example, the Yarmouth, the mills were started in 1769 and the first cotton mill was built by the company. During the Civil War the high duties stimulated the silk industry and diversified its product.
TEXTILE INDUSTRY

New England industry was centralized in Massachusetts and Rhode Island, and these grouped largely at Providence, Fall River, Lowell and Manchester, N. H., also at and Philadelphia, the largest cotton

storing city. This before the Civil War the general technical growth up to 1860 and been briefly given above (more detailed machinery can be found under title) with its greatly improved machinery thus allowing larger output per man higher wages, and competition with imports. But the radical changes in the industry are shown by the following New England's 570 establishments in 1860 fallen to 308 in 1905, though the number of spindles had increased from 3,859,131,911,000 in those years from the 1860's smaller factories to lose ground and rapid growth of the more prominent already capitalized mills. Then came the mushroom-like growth of the Southern textile industry, the Northern cotton-mill owners of whose industry was threatened by spinning with its low-priced labor. 890 to 1905 we get the following statistics that show the advance of the North and the Southern mills maintained a healthy advance:

<table>
<thead>
<tr>
<th>Value of Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>1890</td>
</tr>
<tr>
<td>$24,925,000</td>
</tr>
<tr>
<td>$31,784,000</td>
</tr>
<tr>
<td>$30,789,000</td>
</tr>
<tr>
<td>$30,957,000</td>
</tr>
<tr>
<td>$14,935,000</td>
</tr>
<tr>
<td>$15,067,000</td>
</tr>
<tr>
<td>$2,748,000</td>
</tr>
<tr>
<td>$481,112,000</td>
</tr>
</tbody>
</table>

number of establishments in the South was 165; by 1900, 350 and of larger size, and the table following shows a rapid growth to 1910:

<table>
<thead>
<tr>
<th>State</th>
<th>Establishments</th>
<th>Spindles</th>
<th>Looms</th>
</tr>
</thead>
<tbody>
<tr>
<td>1890</td>
<td>1910</td>
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<td>1890</td>
<td>1910</td>
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</tbody>
</table>

A general survey of the progress of the United States in its cotton industry is best told by the statistics. Thus we have for woven goods in square yards and values the following figures:

<table>
<thead>
<tr>
<th>1899</th>
<th>1904</th>
<th>1909</th>
<th>1914</th>
</tr>
</thead>
<tbody>
<tr>
<td>4,485,005,418</td>
<td>5,056,779,500</td>
<td>6,267,561,279</td>
<td>6,810,712,349</td>
</tr>
<tr>
<td>$399,668,011</td>
<td>$371,539,626</td>
<td>$447,167,319</td>
<td>$488,728,054</td>
</tr>
</tbody>
</table>

Other interesting figures are: The cotton consumption in the textile mills in pounds:

<table>
<thead>
<tr>
<th>Year</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1914</td>
<td>2,679,934,776</td>
</tr>
<tr>
<td>1915</td>
<td>2,462,225,140</td>
</tr>
<tr>
<td>1904</td>
<td>1,981,804,446</td>
</tr>
<tr>
<td>1899</td>
<td>1,923,704,500</td>
</tr>
</tbody>
</table>

Cotton manufactures in 1914 were valued at $701,300,933; in 1909 at $628,391,813; in 1904 at $450,407,749; in 1899, $339,200,320. The equipment of spindles producing these outputs was in 1914, 30,887,499; in 1909, 27,425,608; in 1904, 23,195,143; in 1899, 19,050,052. These were used on the following number of looms (all classes): 1914, 670,661; 1909, 665,049; 1904, 559,296; 1899, 455,752.

Improved Spinning.—The improvements in spinning have been so rapid since 1870 that most of our large corporations have been compelled to replace their spinning-frames two or three times in that interval. A similar statement can be made regarding no other branch of textile manufacture; and it is probably true that if the American woolen mills had been forced, as the cotton mills have been, to abandon machinery as soon as it became in any degree obsolete, their ability to face foreign competition would be more nearly in keeping with that shown by our cotton manufacturers.

Large Corporations.—The conditions here narrated have thrown the cotton manufacture more and more into the hands of large corporations, which now almost universally conduct it. The wool manufacture, on the other hand, while it numbers some of the greatest corporations in the land, is still largely in the hands of individuals and partnerships, and the bulk of the mills are comparatively small in product of the Southern mills has been coarse yarn and cloth while the North maintained its hold on the finer goods, and reduces great output of coarse goods.

* Not including lace, tape, webbing and other cotton products, which give an added value of $44,183,931 for 1914; $36,936,069 for 1913; $26,454,297 for 1904, and $25,-297,385 for 1903.
TEXTILE INDUSTRY

capacity. The more recent tendency in the wool manufacture, for obvious reasons, is strongly in the direction of the corporate form of management.

Fine Cottons.—The quantity of fine cotton goods made in American mills continues to be very small in comparison with the whole product and in the bulk of consumption this class of cottons is still imported. So there is ample room remaining for further development of the American cotton manufacture. Into this field we are entering with characteristic Yankee energy. Within comparatively few years mills have been successfully established in New England which spin yarns as fine as Nos. 150 or 260; and there are mills at New Bedford, Taunton and elsewhere which make, in wonderful variety, fabrics as delicate in texture and as artistic in design and coloring as any which reach this country from the machine-using nations of Europe.

Wool.—The range of products made in American wool factories is as wide as the multifile uses to which this most valuable of all the fibres is put. They divide themselves naturally into four great groups, leaving the hosiery and knit goods out of the classification: woolen mills, worsted mills, carpet mills and felt mills. There are the various classes of classifications of spinning, weaving, dyeing and finishing mills, although, as a rule, all these separate processes of the manufacture of wool continue to be carried on jointly in this country, as the related parts of the one operation of manufacturing.

WOOL MANUFACTURES, INCLUDING WORSTEDS, FELTS, CARPETS, ETC.

<table>
<thead>
<tr>
<th></th>
<th>1914</th>
<th>1909</th>
<th>1904</th>
<th>1999</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of establishments</td>
<td>970</td>
<td>1,124</td>
<td>1,213</td>
<td>1,484</td>
</tr>
<tr>
<td>Persons employed</td>
<td>204,716</td>
<td>209,082</td>
<td>186,099</td>
<td>166,716</td>
</tr>
<tr>
<td>Wage-earners</td>
<td>195,202</td>
<td>202,030</td>
<td>186,099</td>
<td>166,716</td>
</tr>
<tr>
<td>Capital</td>
<td>$497,609,293</td>
<td>$506,355,384</td>
<td>$370,601,041</td>
<td>$310,179,708</td>
</tr>
<tr>
<td>Wages</td>
<td>94,347,081</td>
<td>97,065,560</td>
<td>79,707,524</td>
<td>67,934,077</td>
</tr>
<tr>
<td>Cost of material</td>
<td>208,054,941</td>
<td>212,441,041</td>
<td>181,501,041</td>
<td>161,991,275</td>
</tr>
<tr>
<td>Value of product</td>
<td>464,249,813</td>
<td>507,176,710</td>
<td>380,914,003</td>
<td>330,989,486</td>
</tr>
<tr>
<td>Manufactured product</td>
<td>502,857,383</td>
<td>582,503,710</td>
<td>483,520,100</td>
<td>434,810,753</td>
</tr>
</tbody>
</table>

Specialization.—In the wool manufacture, as in the cotton and silk manufacture, we have many establishments which, in completeness of structure, in perfection of machinery, in the details of mechanical equipment, and in swiftness of management, are nowhere in the world surpassed. Indeed, it is only in this country that we find, on a very large scale, textile mills in which are performed all the separate processes for the manufacture of our various varieties of goods. Elsewhere they have learned that the greatest economy and the best practical results are secured by specializing the processes. Thus in Bradford, England, are enormous establishments which do nothing but comb wool into tops, either on commission or for sale. Other great mills do nothing but spin tops into yarn, and generally they confine their operations to a limited variety of yarns. Still others, buying their yarn, devote themselves exclusively to twisting, and in the middle of a fourth class of establishments take the woven goods and dye and finish them for the merchants, who are the men who find the ultimate market for all the specialists who have been thus employed upon the goods. In this specialization of the different branches of the work exists the characteristic distinction between the American and the foreign textile mills of today. Investigation appears to show that the English method is far superior, and that ultimately we must gravitate into the former, if we are to cut any figure in competition for the world's market. The manufacturer who devotes his whole energies to one particular thing, and studies to do that one thing as cheaply and as well as it can be done, can do it better and more cheaply than the manufacturer who is doing half a dozen different things at the same time. This is not a theoretical deduction, but an axiom founded upon prolonged experiment and experience. Bradford manufacturers who have tried both methods say there is always a gain in economy when the weaver buys his yarn, instead of spinning them himself. Obviously the English method requires a smaller investment, it secures a simpler and more perfect autonomy in operation, involves less waste and avoids the accumulation of superfluous raw material. The American woolen mill was evolved from conditions which rendered it impossible to attempt even to approach perpetually impossible. It was situated in some isolated spot, drawn thither by a superior water power, with no railroad to facilitate quick transportation, and was necessarily a complete mechanical entity, however crude its machinery. In a word, it must perform under

one roof all the processes necessary to convert the greasy wool into the finished cloth ready for the market. Thus there sprung up all over the country little woolen mills, each one independent in itself; as the country grew some of these little mills became large mills; other large mills grew up beside them; gradually grew centres in which the wool manufacture predominated; but conditions were long in appearing which tended to that specialization of processes which has marked the English method from the very introduction of automatic machinery. It followed that the American mill-owner, even of a small mill, was compelled to make a variety of goods, in order to use up advantageously all the grades of material which came out of the sorting of his wool. Naturally he could not produce a variety of products as cheaply and as successfully as he could have manufactured one particular line upon which his whole attention was cast. The habit of manufacturing, forced upon us originally by the logic of the situation, are tenacious.
TEXTILE INDUSTRY

The home market, and of which their production has been enormous. Many of these goods are woven upon a cotton warp, and into some of them enters more or less of the revamped wool known as ‘shoddy.’ We have much to learn, however, in the handling of this class of materials, before we shall equal the pertinence of foreign manufacturers.

WOOLEN GOODS.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>Establishments</th>
<th>Wage-earners</th>
<th>Capital</th>
<th>Wages</th>
<th>Cost of material</th>
<th>Value of product</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>$107,872,000</td>
<td>$24,204,000</td>
<td>$63,996,000</td>
<td>$103,816,000</td>
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<tr>
<td>501</td>
<td>501</td>
<td>49,165</td>
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<tr>
<td>587</td>
<td>587</td>
<td>52,180</td>
<td>120,320,000</td>
<td>22,575,000</td>
<td>65,652,000</td>
<td>107,119,000</td>
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<tr>
<td>792</td>
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<td>73,747</td>
<td>140,302,000</td>
<td>28,828,000</td>
<td>87,831,000</td>
<td>142,197,000</td>
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<tr>
<td>1,035</td>
<td>1,035</td>
<td>68,893</td>
<td>124,886,000</td>
<td>24,757,000</td>
<td>71,012,000</td>
<td>118,430,000</td>
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<tr>
<td>1,311</td>
<td>1,311</td>
<td>76,915</td>
<td>130,900,000</td>
<td>26,139,000</td>
<td>82,270,000</td>
<td>133,578,000</td>
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<td>1,900</td>
<td>1,900</td>
<td>86,204</td>
<td>96,096,000</td>
<td>22,836,000</td>
<td>106,846,000</td>
<td>160,607,000</td>
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<tr>
<td>2,891</td>
<td>2,891</td>
<td>80,053</td>
<td>98,874,000</td>
<td>26,878,000</td>
<td>96,433,000</td>
<td>61,895,000</td>
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<tr>
<td>1,559</td>
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<td>39,252</td>
<td>28,119,000</td>
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</tbody>
</table>

Manufacturers in that city. The small of capital required to equip a little ed permits enterprise. The comparative cheapness of pro- under such conditions enables them to ir own against the big establishments mited capital at their back. American Woolen Specialties.—The bulk small wool manufacturing establish- the United States are woolen mills as distinguished from worsted mills. iceable that the number and product woolen mills decrease from census to s the worsted manufacture gets more stablished here, and the more popular fabric comes into wider use. But lines of woolen goods in the he of which American mills have world-wide pre-eminence. Prominent item are flannels and blankets of every d variety. The American wools are suited for these goods, and for many at our American mills have practically the home market. Other mills make of woolen dress goods for ladies’ th equal success. The bulk of our mills are, however, engaged upon the

 Worsted.—The worsted manufacture was late in getting lodgment in the United States and has been slow in assuming proportions commensurate with its importance abroad. Early in the forties there were two or three large worsted mills erected in New England for the production of worsted fabrics or stuff goods for women’s wear; but the manufacturer made little headway until after the close of the Civil War, and it was not until about 1870 that we began making men’s wear worsted goods. Since then the development of the manufacture along both lines has been phenomenal. In the manufacture of fine men’s wear goods, both in woolens and worsted, a few American mills have been equally successful; their products sell side by side with the best makes of foreign goods. Another obstacle is the high cost of labor, which counts more strongly in fine wool goods than in the cheaper grades or in cottons and silks, because of the much greater care and skill and labor that must be bestowed upon their finishing. Woolen goods are from carded wool, worsted from combed wool. The popularity shown to worsteds has resulted in a great growth in that class of goods, checking the advance of the manufacture of woolen goods as is shown by the following tables:

WORSTED GOODS.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>Establishments</th>
<th>Wage-earners</th>
<th>Capital</th>
<th>Wages</th>
<th>Cost of material</th>
<th>Value of product</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>$281,781,000</td>
<td>$51,149,000</td>
<td>$182,801,000</td>
<td>$92,897,000</td>
</tr>
<tr>
<td>298</td>
<td>298</td>
<td>109,527</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>324</td>
<td>324</td>
<td>111,012</td>
<td>298,058,000</td>
<td>47,152,000</td>
<td>200,787,000</td>
<td>304,837,000</td>
</tr>
<tr>
<td>256</td>
<td>256</td>
<td>69,251</td>
<td>152,265,000</td>
<td>20,270,000</td>
<td>109,638,000</td>
<td>156,081,000</td>
</tr>
<tr>
<td>186</td>
<td>186</td>
<td>67,008</td>
<td>132,168,000</td>
<td>77,075,000</td>
<td>120,314,000</td>
<td>43,239,000</td>
</tr>
<tr>
<td>76</td>
<td>76</td>
<td>18,803</td>
<td>40,374,000</td>
<td>5,683,000</td>
<td>22,014,000</td>
<td>31,536,000</td>
</tr>
<tr>
<td>102</td>
<td>102</td>
<td>12,920</td>
<td>10,086,000</td>
<td>4,306,000</td>
<td>14,308,000</td>
<td>7,782,000</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>2,378</td>
<td>3,230,000</td>
<td>544,000</td>
<td>2,443,000</td>
<td>1,258,000</td>
</tr>
</tbody>
</table>

Felted Wool.—The manufacture of felted wool is comparatively small here and elsewhere and the importations are comparatively insignificant in volume. Felted wool was the earliest form into which this fibre was manufactured, the primitive races discovering, before they had
Textile Industry

learned to spin and weave, that peculiar characteristic of wool which causes it to mat together by the application of heat, moisture and pressure, into a firm and smooth texture, susceptible of a great variety of uses. Modern machinery has utilized this peculiarity for many purposes which, while limited, are economically important. Tablecloths and floor coverings, and hats for men's and women's wear, are the most ordinary; but they are also used for shoe linings, sheathing materials, polishing purposes, etc. The hat manufacture, formerly confined to wool for its raw material, has found that fur is better suited for this use; and the processes of manufacture are so different from those employed in spinning and weaving mills that the hat-manufacturing establishments, in which the United States has always been pre-eminent, are not ordinarily classed among the textile mills.

Carpets.—Perhaps our most notable achievement in the textile line has been in the carpet manufacture. Beyond question the United States is the greatest carpet-manufacturing nation in the world; if we leave out of account the hand-loom productions of the Eastern countries we excel all others not only in the quantity of our production, but in the variety of our carpets, in the excellence of design and workmanship, and in general adaptability to popular needs. The production includes twoply and three-ply ingrains, Brussels, moquettes, tapestries, velvets, Smyrnas and the highest grades of Axminsters and Aubussons. The annual consumption of this product by the American people begins to approach 100,000,000 square yards. The popular reason assigned for this unique development is the general prosperity of our people, the high wages earned permitting families of all grades of life to indulge in the luxury of floor coverings to an extent elsewhere unknown. Stimulated by the lucrative market thus offered, American manufacturers have made larger and more important contributions to the mechanism of the carpet manufacture than those of all other nations combined. The real development of the machine industry dates from the successful application of power to the weaving of ingrain carpets by the late Erastus B. Bigelow in 1834. Subsequently he invented Jacquard looms for weaving Brussels and Wiltons, which produced carpets pronounced by the jury at the London Exposition of 1851 to be "better and more perfectly woven than any hand-loom carpets that have ever come under the notice of the jury."

A still later invention of Bigelow's was for weaving tapestry carpets. His inventions are at the base of all the power-loom carpet-weaving now done in Europe. Subsequent inventors have greatly improved them and have added new inventions, such as those for weaving Axminsters and Smyrna rugs. By their skill and enterprise the American carpet manufacturers have not only retained the control of their own market, except in the matter of the Eastern hand-made rugs, but they have in some instances successfully forced their products upon the European markets.

In 1914 there were 97 establishments in the United States producing carpets and rugs of other than rugs, keeping 33,100 persons engaged; the wage-earners numbered 31,309 and were paid $14,715,615. Capital employed was $85,153,828. Jute carpets and rugs were to the added value of $1,172,277. Rag produced had a value of $2,799,439. Growth of the industry is shown by the following figures:

<table>
<thead>
<tr>
<th>Year</th>
<th>Carpets and rugs (other than rug)</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1914</td>
<td>66,340.374</td>
<td>$64,685.322</td>
</tr>
<tr>
<td>1908</td>
<td>81,218.981</td>
<td>$66,906.138</td>
</tr>
<tr>
<td>1904</td>
<td>82,670.943</td>
<td>$50,861.775</td>
</tr>
<tr>
<td>1900</td>
<td>76,410.928</td>
<td>$43,351.129</td>
</tr>
</tbody>
</table>

Hosiery and Knit Goods.—In one branch of the textile industry progress in United States has outstripped the world—hosiery and knit-goods manufacture. Most machine-made knit goods are turned out annually here than in all other countries combined. The explanation is somewhat as in the case of carpets. Our people wear more underwear than other people; they are not only obliged to wear more for climatic reasons but they can afford to wear more; and the general desire for personal comfort in wearing panty hose results in an enormous distribution of products of these mills. The beginnings of the industry are well within the lifetime of manufacturers still living, and until 1882 and 1883 silk stockings remained the only hosiery made. The only form of textile work which the machine had not wrested from the housewife. In that year Eberhard Eggers successfully applied the principle of knitting by power, at Cohoes, N. Y. His machine was simply the square stocking-frame of William Lee adapted to power. From that adaptation dates a revolution in underwear, which had previously consisted wholly of flannel, fashioned and sewed at home, according to the individual needs. The revolution gathered momentum gradually, as invention after invention—almost all of American origin—perfected the knit-machine; but once the new industry was fairly and firmly established, it spread with amazing rapidity. The great variety of goods made facilitates the tendency, peculiar to this industry, toward the building of comparatively small mills, requiring but moderate capital, and it happens in consequence that these mills spring
TEXTILE INDUSTRY

over the country and can now be found in every State. Many of them employ cotton as a raw material; others use chiefly and still others manufacture what are known as merino knit goods or mixed goods—mixed with wool in proportions varying 0 to 75 and 90 per cent of cotton, according to the particular market sought. The ever since, as the statistics show. One drawback has been the difficulty of getting the American agriculturist to grow a flax crop, in spite of placing a high tariff on the raw stuff to tempt the grower. Matters have, however, changed considerably already, the industry has obtained a firm foothold and the statistics show steady growth.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>Establishments</th>
<th>Wage-earners</th>
<th>Capital</th>
<th>Wages</th>
<th>Cost of material</th>
<th>Value of product</th>
</tr>
</thead>
<tbody>
<tr>
<td>1914</td>
<td>1,401</td>
<td>150,145</td>
<td>$215,537,000</td>
<td>$59,605,000</td>
<td>$146,291,000</td>
<td>$111,750,000</td>
</tr>
<tr>
<td>1909</td>
<td>1,264</td>
<td>128,708</td>
<td>162,855,000</td>
<td>44,527,000</td>
<td>106,416,000</td>
<td>90,156,000</td>
</tr>
<tr>
<td>1914</td>
<td>1,079</td>
<td>103,715</td>
<td>106,663,000</td>
<td>31,536,000</td>
<td>76,594,000</td>
<td>59,964,000</td>
</tr>
<tr>
<td>1899</td>
<td>921</td>
<td>83,387</td>
<td>81,861,000</td>
<td>24,358,000</td>
<td>51,072,000</td>
<td>44,411,000</td>
</tr>
<tr>
<td>1889</td>
<td>796</td>
<td>59,588</td>
<td>50,608,000</td>
<td>16,578,000</td>
<td>35,862,000</td>
<td>31,379,000</td>
</tr>
<tr>
<td>1879</td>
<td>359</td>
<td>28,885</td>
<td>15,379,000</td>
<td>6,701,000</td>
<td>15,211,000</td>
<td>13,956,000</td>
</tr>
<tr>
<td>1914</td>
<td>131</td>
<td>375</td>
<td>469,000</td>
<td>153,000</td>
<td>872,000</td>
<td>747,000</td>
</tr>
<tr>
<td>1909</td>
<td>110</td>
<td>567</td>
<td>786,000</td>
<td>214,000</td>
<td>1,572,000</td>
<td>1,232,000</td>
</tr>
<tr>
<td>1899</td>
<td>65</td>
<td>377</td>
<td>280,000</td>
<td>79,000</td>
<td>518,000</td>
<td>392,000</td>
</tr>
<tr>
<td>1899</td>
<td>85</td>
<td>304</td>
<td>203,000</td>
<td>76,000</td>
<td>351,000</td>
<td>288,000</td>
</tr>
<tr>
<td>1879</td>
<td>39</td>
<td>1,814</td>
<td>153,000</td>
<td>138,000</td>
<td>447,000</td>
<td>208,000</td>
</tr>
</tbody>
</table>

Statistics.—The value of all textile products in the United States for 1850 was $128,769,971 and this has increased to $931,494,566 in 1900. The census report for 1900 shows the following:

The number of cotton spindles in operation in 1900 was 19,008,352, as compared with 14,188,103 in 1890, and 10,653,435 in 1880. This striking increase is due in a large measure to the wonderful growth of the industry in the South since 1880, as before that date the cotton manufacturing industry existed there only on a most restricted scale. In fact, the growth of

<table>
<thead>
<tr>
<th>YEAR</th>
<th>Establishments</th>
<th>Wage-earners</th>
<th>Capital</th>
<th>Wages</th>
<th>Cost of material</th>
<th>Value of product</th>
</tr>
</thead>
<tbody>
<tr>
<td>1914</td>
<td>22,995</td>
<td>1,496,644</td>
<td>$2,810,848,000</td>
<td>$672,351,000</td>
<td>$1,993,058,000</td>
<td>$3,414,615</td>
</tr>
<tr>
<td>1872</td>
<td>1,442,664</td>
<td>1,248,613</td>
<td>2,488,463,000</td>
<td>592,261,000</td>
<td>1,145,516,000</td>
<td>840,199</td>
</tr>
<tr>
<td>17,042</td>
<td>1,156,302</td>
<td>1,744,106,000</td>
<td>419,842,000</td>
<td>1,246,562,000</td>
<td>1,217,441</td>
<td></td>
</tr>
<tr>
<td>17,647</td>
<td>1,022,123</td>
<td>1,340,634,000</td>
<td>341,652,000</td>
<td>894,846,000</td>
<td>1,028,006</td>
<td></td>
</tr>
</tbody>
</table>

Linen.—The line of textiles which has the greatest obstruction in the United States products, etc., in the textile industries follow:

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<table>
<thead>
<tr>
<th>YEAR</th>
<th>Establishments</th>
<th>Wage-earners</th>
<th>Capital</th>
<th>Wages</th>
<th>Cost of material</th>
<th>Value of product</th>
</tr>
</thead>
<tbody>
<tr>
<td>1914</td>
<td>22,995</td>
<td>1,496,644</td>
<td>$2,810,848,000</td>
<td>$672,351,000</td>
<td>$1,993,058,000</td>
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</tr>
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<td>1872</td>
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<td>1,145,516,000</td>
<td>840,199</td>
</tr>
<tr>
<td>17,042</td>
<td>1,156,302</td>
<td>1,744,106,000</td>
<td>419,842,000</td>
<td>1,246,562,000</td>
<td>1,217,441</td>
<td></td>
</tr>
<tr>
<td>17,647</td>
<td>1,022,123</td>
<td>1,340,634,000</td>
<td>341,652,000</td>
<td>894,846,000</td>
<td>1,028,006</td>
<td></td>
</tr>
</tbody>
</table>
The extraordinary growth of the exports of textiles from the United States of America is shown in the following table:

<table>
<thead>
<tr>
<th>Year</th>
<th>1908</th>
<th>1912</th>
<th>1914</th>
<th>1916</th>
<th>1918</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silk, manufacturers of</td>
<td>$720,368</td>
<td>$1,992,765</td>
<td>$2,307,605</td>
<td>$5,204,813</td>
<td>$12,140,789</td>
</tr>
<tr>
<td>Cotton, manufacturers of:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cloth</td>
<td>14,268,083</td>
<td>31,888,908</td>
<td>28,844,937</td>
<td>40,881,209</td>
<td>103,416,982</td>
</tr>
<tr>
<td>Knit goods</td>
<td>1,482,751</td>
<td>1,858,826</td>
<td>2,546,922</td>
<td>20,546,022</td>
<td>13,853,161</td>
</tr>
<tr>
<td>Woolens</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carpets</td>
<td>63,074</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>57,152</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The wonderful strides given in these figures for 1910-18, of course, reflect the consequences of the war cutting off Europe from her exports and the consequent enormous increase of our products in demand from South America and other foreign states.

Future Needs.—The American textile manufacturers have left little to be desired in the direction of cheapening textile products without deteriorating quality. They have built and equipped mills which rank with any in the world. They have planted on this continent machinery enough to supply all top in our wants of our people, except in a comparatively few lines of very fine fabrics. They have managed these mills with rare business sagacity, and as a rule with notable financial success. They have taken one specialty after another which had never been attempted here, and transported its manufacture from across the water, literally inventing anew the necessary machinery, as in the case of braids and plush goods, when they could not obtain it otherwise. They have taken these several textile industries, which have been localized and specialized in Europe for generations, and in less than a century have made them one of the chief corner-stones of our national wealth. They have contributed far more than their share to the mechanical development which makes the labor of a single operative stand for that of a regiment of hand-workers in the 18th century. They have fallen short only in contributing to the artistic development of the industry. They have been imitators instead of originators, although there are among them many striking and gratifying exceptions to this rule. But American-made goods do not bear, generally speaking, any distinctive artistic characteristics which distinguish them as American-made; and, generally speaking, they are inferior in this respect to the best products of foreign looms. All this is natural—natural to a new country in which utility everywhere predominates over the ornamental. The next great forward step in our textile manufactures must be in the artistic rather than the mechanical direction, for there we recognize its weakest point. In the designing of patterns, in the use and application of dyes, in the staple product, in bleaching and finishing, in fabrics the artistic element, to lift the manufacture into an art, our textile mills are still far from the top of the ladder. This deficiency is not in any sense peculiar to the textile industries. It is an educational difficulty in which our people as a whole may be said to share. It is incident to a crude country of limited facilities in art directions. What needs to be done is to supply more facilities.
in 1909 England used 39,000,000 mule spindles against 7,900,000 ring spindles. In 1909, England's output of woolen tissues (ool or mixed) amounted to 188,125,000 yards valued at $88,000,000. Her worsted textiles (all wool or mixed) were 209,109,000 yards valued at $86,653,000. Other products at year were:

<table>
<thead>
<tr>
<th>Product</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>tapestry and other</td>
<td>6,901,000</td>
</tr>
<tr>
<td>re stuffs (yds.)</td>
<td>50,566,000</td>
</tr>
<tr>
<td>and damaskes (yds.)</td>
<td>25,766,000</td>
</tr>
<tr>
<td>(pairs)</td>
<td>3,813,000</td>
</tr>
<tr>
<td>(pairs)</td>
<td>3,130,000</td>
</tr>
<tr>
<td>sy number</td>
<td>1,142,000</td>
</tr>
<tr>
<td>weaving fabrics</td>
<td>2,900,000</td>
</tr>
<tr>
<td>aids, etc.</td>
<td>224,425,000</td>
</tr>
</tbody>
</table>

England's cotton product we have:

1907: Piece goods 7,087,000 yards at about $411,620,000, of which were goods (not dyed or printed) 2,200,000 yards; dyed, but not printed 1,142,524,000 yards; printed (dyed or not) 1,326,059,000.

Iks amounted to the following figures:

<table>
<thead>
<tr>
<th>Product</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BROADSTUFFS</td>
<td></td>
</tr>
<tr>
<td>yarn</td>
<td>10,527,000</td>
</tr>
<tr>
<td>Value</td>
<td>4,345,000</td>
</tr>
<tr>
<td>silk (net or spun)</td>
<td>7,941,000</td>
</tr>
<tr>
<td>Value</td>
<td>3,600,000</td>
</tr>
<tr>
<td>goods (neckties, etc.)</td>
<td>3,253,000</td>
</tr>
<tr>
<td>trimmings, etc.</td>
<td>6,790,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UNDERWEAR</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>vests, etc.</td>
<td>4,525,000</td>
</tr>
<tr>
<td>Value</td>
<td></td>
</tr>
<tr>
<td>if hose, etc.</td>
<td>22,040,000</td>
</tr>
<tr>
<td>Value</td>
<td>860,000</td>
</tr>
<tr>
<td>cotton, wool, silk, etc.</td>
<td>2,150,000</td>
</tr>
<tr>
<td>Value</td>
<td></td>
</tr>
<tr>
<td>kettle of hose made in 1907.</td>
<td>72,043,000</td>
</tr>
</tbody>
</table>

Land's exports were:

<table>
<thead>
<tr>
<th>Year</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1916</td>
<td></td>
</tr>
<tr>
<td>1917</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Materials</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>dry goods</td>
<td>$443,939,450</td>
</tr>
<tr>
<td>Value</td>
<td>$564,052,485</td>
</tr>
<tr>
<td>manufactured fabrics</td>
<td>177,115</td>
</tr>
<tr>
<td>Value</td>
<td>78,434,000</td>
</tr>
<tr>
<td>manufactured fabrics</td>
<td>324,528,245</td>
</tr>
<tr>
<td>Value</td>
<td>264,238,370</td>
</tr>
<tr>
<td>manufactured fabrics</td>
<td>72,040,590</td>
</tr>
<tr>
<td>Value</td>
<td>10,050,520</td>
</tr>
<tr>
<td>manufactured fabrics</td>
<td>72,040,590</td>
</tr>
<tr>
<td>Value</td>
<td>84,719,850</td>
</tr>
</tbody>
</table>

In 1840 Germany had 638,338 spindles worked by hand 1860 to about 2,000,000. A report gave her 10,920,426 spindles for spinning. In Crefeld, the centre of Germany's silk industry, were last reports of factories making silk cloths and 28 es producing velvets. The total Ger- Ick product has been estimated at about $333.

According to the last statistics available had 7,500,000 cotton spindles. These were chiefly located, before the war, at Lille, x, Toucing, Epinal, Saint Die, and in the Paris area. They employed 12,000 power looms and 40,000 hand. Her woolen fabrics were chiefly produced at Lyons for high goods. Silks of fine quality were also at Saint Etienne and in Picardy. The industry employed from 85,000 to 90,000 wens on over 20,000 power looms. They produced 2,500,000 kilograms of wrought silk and 1,000,000 kilograms raw silk. Production follows:

<table>
<thead>
<tr>
<th>Product</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lyons</td>
<td>409,000,000</td>
</tr>
<tr>
<td>Saint Etienne</td>
<td>8,205,000</td>
</tr>
<tr>
<td>Picardy</td>
<td>4,600,000</td>
</tr>
</tbody>
</table>

in all about $86,361,000.

Foreign Schools.— England's textile operatives are supplied with technical training in such schools as Bolton Technical School, Bradford Municipal Technical College, Oldham Technical Institute, Halifax Municipal Technical College, Huddersfield Technical College, Keighley Institute, Yorkshire College at Leeds, Oldham Technical School, Rochdale Municipal Technical School, Salford Royal Technical Institute, etc. Germany has textile schools at Aix-la-Chapelle, Crewe, Cottbus, Falkenberg, Muhlheim-on-Rhine, Berlin, Chemnitz, Muhlan, etc. In France technical education for the textile industries is given at Elbeuf, Tourcoing, Roubaix, Saint Etienne, Lyons, Flers, Sedan, Bohain. In Austria are textile schools at Asch, Schoenberg, Warnsdorf, Ruthenberg, etc. In Switzerland are textile schools at Wattyl, Zürich, etc. In Italy we find such at Prato, Arguno, etc.

TEXTILE PRINTING. The decorating of fabrics by printing is one of the oldest of the arts. There are evidences that it was practised in Egypt 2000 b.c., and it was used in ancient Assyria, India and China. Opinions are divided as to the country of its origin, but it is generally agreed that the art is a memorial of the 13th century. They printed principally silks and linens, and were addicted to gilt and silver designs. In the course of time the art spread to Switzerland, France and England. The print works at Jouy, near Versailles, France, were the first to become famous. It is believed that fabrics were printed in England as early as 1620, but the first record of systematic manufacture was at Richmond-on-Thames in 1690. All this early printing was done from blocks by a method very similar to block printing for books. The designs were cut in the surface of a block, and if many fine lines were desired, the surface of the wood was cut away and thin strips of copper twisted and cut to the required form for the lines, and forced tight into the wood until the top of the copper was at the desired level. If a large solid surface of color was required, it was found better to surface the wood with felt, as it carried the ink better than the wood. That very beautiful results can be had by block printing on fabrics is evidenced by the fact that it is still practised by amateurs as a fad and by a few artistic workmen in large cities. Block printing was long done entirely by hand, the block being laid on the cloth being covered with felt or the like and impressed with a mallet or by rubbing. But presses for block printing became common in England in the 18th century and continued to be used long after the cylinder method of textile printing came into use. Sev-
er had the idea of printing with a roller, but Thomas Bell, of England, was the first to bring out a practicable cylinder machine, in 1783. His object was twofold, to print several colors at once and to do away with bad joints, which were all too common in block printing, wherever the pattern was repeated. In 1785 he patented a six-cylinder machine, which was the prototype of the modern cylinder cloth-printing machines. Though vastly superior, the invention was accepted slowly, and in 1840 it is reported that only 556 cylinder machines were in operation in Great Britain as against 14,000 tables for block printing. Engraving on the cylinders was for a long time tedious and expensive, the first radical improvement here being Gormetz's engraving machine in 1828. The pantograph machine for duplicating patterns on cylinders in enlarged size came in 1834, and thereafter the art of textile printing advanced very rapidly. The patterns or designs are now made on paper and transferred to the cylinders, and either cut into with the pantograph or etched on copper. They are also sometimes made in soft steel and later hardened. A modern cylinder textile press has a great central drum around which the cloth travels. About this drum are a series of engraved cylinders with inking apparatus. The cloth is led in from a reel and passes under perhaps six or eight cylinders, receiving a color impression from each, in exact register, and is then led to a drying apparatus, that is only an enormous reel, with adjustments for keeping the printed surfaces apart until quite dry. Commonly the colors are put on lightly for surface effect, and in other cases the color is forced through the cloth, so as to get an effect on the reverse side. Most exquisite printing is done on silks, linens, woolens and cottons, as can be seen by anyone who will visit the counters of any large dry-goods store. The tapestries, draped figures, figured dress goods, cloths for upholstery, etc., produced by this process are endless, involving all the colors of the rainbow; in fact the perfection attained in the art is truly amazing. Consult Rothwell, 'Printing of the Textile Fabrics' (Philadelphia 1882); United States Bureau of Manufactures, 'Statistics of Cotton Goods' (1912); Knecht and Fothergill, 'Principles and Practice of the Textile Printing' (London 1912); Beaumont, 'Color in Woven Designs' (1912). See TEXTILES; WEAVING.

TEXTILES, or TEXTILE FABRICS. Stuffs made by the weaving together of threads of any sort, so as to produce a material with a nearly solid surface. A fishing-net or the like is not a textile fabric because the cords which compose it are not woven together, but cross one another at equally distant intervals and are strongly knotted at those points. But practically any cord, although very open, because the threads are merely held by their own friction. On the other hand, if a basket is made by weaving together strips of wood or bamboo, such a material is hardly called a textile, but this merely because of its totally different nature, although much of the primitive domestic work is based upon such very simple portions of the loom; for it seems that man is never tired of producing, by up and down, in and out,
TEXTILES

In the most complicated patterns, such as the Japanese send us daily, in which a row of dragons will be with a row of representations of the pearl with its flames, and those again row of kylins or other fabulous monsters being interspersed. First the delicate leaves of the camellia and bursting flowers of the pomegranate, the same being red in many colors—even in such a concern it is readily seen that these figures, though in regular sequence, are not introduced in a definite and unaltered sequence. Thus a blue thread of the not appear more than once in each or a certain row across a piece of stuff; appearance of the blue thread may be void of a quarter of an inch long only, if the rest of that blue thread is found anging loose behind the finished fabric. His blue thread may not appear at all in seven inches of the length of the stuff, a very different method from the pattern. Still that blue loop in the design from the front or "right side" is in each one of the flowers or animals form the cross row of the pattern; and very few of the flowers or animals may be two feet away in the length of e) this blue thread may be replaced by on one, which will also appear at ex- se same intervals and at exactly the site in each one of the flowers or of design. It is interesting to take a very rich fabric with an elaborate pat- ed to examine it with a view to just cularities of weave. Anyone who has a simple loom at work and has mas- e process may then understand in great the workings of the far more elaborate the silk weaver, who is producing pat- fabrics.

Such weaving of patterns it is here as- that the threads are dyed before the is begun. The matter of printing upon calico, thin silk or the like is en- part from the consideration of textile

Printing is done from blocks with most often one pattern; receiving paper instead of a woven stuff, simplest weave made in this way with threads is gingham, the name of which from the East, probably from India, invention of the weave itself. Checks, nd stripes are the natural patterns of 1, but it is also practicable to produce zig-zag and frets, and the stripes them- ay be variegated by patterns on their

Weaves of Persian and Chinese origin "read and softer and more woolly than twisted cotton threads are sometimes active in color effect, woven exactly am is woven.

Ask linen, such as is used for table- is peculiar in that the pat- in elaborate twilled fabric in which the arranged to make a pattern—often even rs and leaves. These patterns are seen by the difference of reflection of light : threads of the linen; for those threads parallel to the direction of the widest band on a given point of view, while those in the other direction look dusky. A of the position of the beholder reverses this effect of light and dark. Moreover it is common that the same pattern is seen in reverse on the other side of the fabric. There is nothing to prevent damask linen being woven with dyed threads in parts of the composition, and occasionally tablecloths of such material come into fashion.

Brocade, a term generally used for very splendid material, means primarily a stuff—composed in part of threads which lie on the surface of the finished stuff (French brocêhes), appearing where the particular color is not far and disappearing again, as explained in the paragraph above. A brocade may be composed of threads all of one color. Thus the silks called damasê (French Damasêes, or Damasêes) have perhaps a pattern of dark green leaves relieved in shining threads upon a background of exactly the same dye, but looking different because of the different and less glis- tening character of the threads; this being caused not by the silk being differently spun, but because of the different way of treatment of the thread in the loom, the long loops lying flat and loosely, and reflecting the light in a different way from the hard pulled threads of the background.

Satin is a material with a silken surface of unusual and uniform glossiness, which is pro- duced by alternately raising and depressing four yarns of the warp across the whole of which the weft is thrown by the shuttle. It will be noted that this is a modification of twilling, and the threads of satin are seen to lie in the same way as those of a twilled cotton. It is evident that such a surface is capable of many modifications. Thus there are some fabrics of silk and wool, or silk and cotton, in which the silk threads are thrown to the surface, lying in very narrow stripes or bands, which show glossy on the background, which also show only in very narrow stripes between the others. These fabrics take different names from year to year.

Again, there are Eastern brocades in which the background is composed entirely of the warp threads in a satin weave of one color; while the flowers of the pattern are made up entirely of the woof threads and these in many colors with gold.

There remains to be mentioned those weaves in which the warp threads only are seen in the finished stuff. The most common form of this is ordinary ribbed silk, in which the warp threads form loops (silks called gros-grain and by other special names), giving a rib running across the stuff. Thus a silk in longitudinal stripes of darker and lighter green, buff and brown, has all its wool threads of a dull brown; while the warp threads of the four colors named form visible ribs in which the colors are alternated in a very elaborate fashion, so that one stripe is made up of a small check in two colors, another is plain and solid, of one color; and in all this the effect of the dark wool is to modify slightly the hues of the stripes by showing between the warp threads.

Velvet is made by carrying the threads of the warp over a rod called a needle, so as to produce a series of ridges or "ribs," as is explained in the last paragraph; and then cutting all these ridges by a sharp instrument passed in as the "needle" is withdrawn. This cutting leaves the
TEXTILES

threads standing up to form the nap or pile, but they are left of different lengths or heights, and, therefore, the whole surface is most carefully sheared and sometimes this shearing is helped by singeing. Fustian, velveteen and corduroy are made by the same process. Plush is a material of the same character and produced in nearly the same way. When the ribbed surface is left without being cut, the term "uncut velvet" is used. This may be used for a part of the surface, while other parts are fully cut and brought to the smooth surface common to velvet. In this way most elaborate patterns are produced—figures being in the velvet pile upon the ground of uncut velvet. Again this may be carried further in producing what is called "pile upon pile" velvet, in which the pile of one part of the pattern is relieved upon the shorter pile of another part of the pattern and this again upon the uncut background. It is evident that such stuffs are of great cost. The beauty of the pattern may also be enhanced by the use of different colors. The Venetian tapestry of the 17th century and modern copies of the same may have a general surface or background of a satin-like texture, upon which the flowers and leaves of the pattern are raised in various shades of gold, silver, green, crimson, buff and the like. The resulting pattern will be of extraordinary richness, effective at a distance and also near at hand. Such pieces made in Venice at the close of the 19th century would cost about 6 francs a yard when woven 20 inches wide.

The further elaboration of decorative weaving by the introduction of other materials than those of twisted threads, is also of importance. Thus "gold thread," as it is called, is commonly made of silver with gilded and then pulled out or "drawn," the silver and gold together, until it is very fine. This is apt to tarnish, the extremely thin gold disappearing with wear, and the silver not having the power of resisting impurities in the air. To avoid this permanently mutilating effect, gold paper is used by the Orientals, the paper being sometimes brown, as it shows on the reverse side of the stuff, and the gilded surface showing on the right side. The less expensive Japanese brocaded silks are often woven in this way. On the other hand, the tarnishing of the metallic gold thread often adds a special charm to the effect of ancient stuffs.

As textile fabrics have been used by all men more advanced than the most degraded savages, the history of textiles is of infinite extent. Even textiles of decorative purpose, those woven in a somewhat complicated way, are of unknown antiquity. Decorative stuffs have been found in Egyptian tombs of very early epochs. The tombs of the Incas and those of South America have been found to contain beautiful weaves. The earliest painted vases found in Egypt show boats with sails, and although some of these sails were perhaps of skin, there are others to which the evident purpose has been to show a woven Western Asia has always been the home of most beautiful designs in weaving, for very early time the people of the great thorough which the Tigris and the Euphrates run were producing fabrics with varied and splendid patterns. This taste the Asiatic feeling for color decor work with the loom took two different in later times. The carpets and rugs with pile were brought from Syria by at least as early as the 8th century A.D. at a later time they were somewhat in Europe, as is clear from the earlier paintings, in which rugs of un Eastern design are seen to cover the or the throne of a sacred person. heavy stuffs used in the West for warm and also for door and window curtains the general name of kelim are woven out pile, the patterns being, therefore, simpler, akin to those described above in connection with gingham and especially twilled material. Venice, the home and also solidly woven, very durable silk made with threads dyed of different colors in such minute patterns that the nowhere shows as broché on the surface been made for so many hundred years; at time of their introduction is hardly asc Cotton stuffs woven in a similar fast very pretty effects of simple patterns, little imported to Europe, but their East adds a great charm to the pop costume. Finally the printing of cottons wood blocks has been practised for tories, the pattern being admirably drawn composed and the colors always interest except where the effect of European does not last as long as the wood blocks are used for the more pre and more beautiful dyes of the East; secondly, to debase the color design orders given by the agents of Western ing houses. The growth of a beautiful industry in Italy, and the extent S made difficult by the rapid changes of which themselves are brought about great desire of large manufacturers in the material and the effect which will buyers. This where a greater willingness of the great dealers to keep fabrics which are out of fashion, be very numerous, because a Canvas stock of any one would be a trouble to house and to show on occasion, and it costs too much to sell goods that in constant demand. Everyone often the material which at a certain found to be exactly what he needed, possibly be obtained a few years later weaving.

Bibliography.—The greater number book devoted to this subject are collecti plates, often in color and beautifully These, however, give merely the the nature of the stuff can only be is rare that a book discussing the manufacture accompanies the best of these books is Fischbach's Der Gewebe. The works on Costi often contain much of the same ma Eastern carpets, Lessing's 'Alt Or.
muster' (Berlin 1877) gives a number of designs collected from paintings of the anc. Vincent Robinson's 'Eastern' (London 1882), and the second series same (London 1883), present a number of results belonging to the author, as a dealer on a large scale and also ar on his own account. The colored are from excellent original drawings. Books on Eastern rugs have been ed during the last few yeras, of which ae Mumford's 'Oriental Rugs' (New 900). The beautiful stuffs known to been used during the Middle Ages are by Franciscus-Michel in 'Recherches commerce,' etc., 'Des etoiles de sole,' vol., Paris 1852, and by Dr. Daniel in 'Textile Fabrics,' the South Ken- illustrated catalogue (London 1870). The author has supplied the 'South Ken- Handbook' (London 1876). Fr. Bock's 'chite der liturgischen Gewänder des liters' (Bonn 1859-71) is the standard n the subject of church ceremonial gar- constantly cited by all writers. One most valuable works for the student of mical side of textiles is 'The Draper's art' by William S. Beck (London and the modern fabrics in common use elligently treated by Caulfield and Sa , the 'Dictionary of Needlework' (London 1885); Mat- J. M., 'Textile Fabrics: Their Physi- rosophical and Chemical Properties' (2d new York 1907); Kinne and Cooley ag and Textiles (ib. 1913); Woolman Gowen, 'Textiles: A Handbook for the and Consumer' (ib. 1913).

RUSSELL STURGIS.

KTUAL CRITICISM, the science by the texts of ancient writings are exam- as to decide upon their authenticity, completeness and the degree of exacti- which they represent the original of the assumed author. This is some- similar to the Higher Criticism; the former is de- e, or at least negative, in its results. Theor of a literary monument founde material furnished by the Lower or 1 Critic. (See Bible — TEXT CRITICISM, pp. 629-651; BIBLICAL CRITICISM, Vol. 3, L-671; ESCHATOLOGY, Vol. 10, pp. 490-491 related references). Consult their 'Apologies, also Cheney, T. R., 'Critica ' (1903); Driver, S. R., 'Introduction to erature of the Old Testament' (1891; 1897); Ginsburg, C. D., 'The Massorah' (5) and 'Introduction to the Masoretico- edition of the Bible' (1897); Langlois, and Seignolos, C., 'Introduction to the of History' (1898); Loisy, A., 'Histoire : du texte et des versions de la bible'. ; Orr, J., 'The Problem of the Old Tes- considered with reference to recent m. (1905); Pfeiffer, C., 'Critic the Preaching of the Old Testament' ; also Barnes, H. E., 'History: Its Rise development,' Vol. 14, pp. 205-264; and Walsh, J. M., the histories of each century from the 1st a.d., to the 19th, in this work.

TEXTURE, as a term applied to rocks, signifies the size and mode of aggregation of the mineral particles that make up the rock, in contrast to structure, which applies to larger features, such as bedding, joints, etc. A brief description of those textures which are particularly useful in classifying rocks will be found in the article on Rocks, in the section on 'Innumerable Rocks.'

TEZCUCO, täs-kō'kō', or TECOCO, Mexico, a town in the state of Mexico, situated on the northeast shore of Tezcuco Lake, 16 miles northeast of the national capital. The modern town has many handsome buildings, a number of manufacturing establishments and railroad repair shops. Cortes stopped here for a period in 1521 when he besieged Mexico. Tezcuco was one of the three confederated Aztec pueblos of the valley of Mexico, and for a time was the chief among them, yielding later the first place to Tenochtitlan. In its neighborhood are several ancient ruins, including terrains of teocallis. Pop. about 6,000; (2) commune surrounding the town; pop. 16,000.

(3) District in the state of Mexico, separated from the capital by a large lagoon; pop. about 60,000. (4) Lake or lagoon about four miles east of Mexico City, 13 by 9 miles, very shallow and surrounded by swamps.

TEZIUTLAN, täs-sé-oot-län', Mexico, the capital of a district of the same name in Puebla state, 50 miles from the Gulf and 12 miles east of Zacapoaxta. Pop. of town, 8,200; of dis- about 25,000.

THACH, Charles Coleman, American educator: b. Athens, Ala., 15 March 1860. He was educated in the schools of North Alabama and at the Alabama Polytechnic Institute from which he was graduated in 1877. He also pursued graduate work at Johns Hopkins University 1880-81. In 1881-82 he was professor of modern languages in Austin College, Texas, and from 1885 librarian and professor of English in the Alabama Polytechnic Institute. In 1902 he was chosen president of this institution which has long been the foremost scientific in- the Southern States. President Thach has greatly expanded the institution since he became president. He was a member of the Alabama History Commission 1898-1900, whose report resulted in the establishment of a Department of Archives and History for Ala- bama. He is also a member of the State textbook commission and the Rhodes scholarship commission.

THACHER, James, American physician and surgeon: b. Barnstable, Mass., 14 Feb. 1754; d. Plymouth, Mass., 26 May 1844. He studied with Dr. Ahner Hersey in Barnstable and in 1775 was appointed surgeon's mate in the Cambridge Hospital under Dr. John Warren. The following year he was made sur- geon's mate in a regiment stationed on Prospect Hill and marched with it to Ticonderoga where he was attached to the general hospital while the place was held by the Continental army, retiring with it in charge of the sick and wounded to Fort Edward and to Albany. He was transferred to the field service at his own request, was made chief surgeon to the
First Virginia regiment in 1778 and the following year was transferred to a New England regiment. He was with the Continental army until the surrender of Cornwallis and was noted for his skill as a surgeon and for his lofty patriotism. On retiring from the army after the war he practised in Plymouth and became well known by his scientific and literary pursuits. He was the author of much professional and literary work. His ‘Military Journal during the American Revolutionary War’ (1823) is an authority on that turbulent time and is notable for the vindication of Washington for his conduct toward André. Other noteworthy publications are ‘Observations on Hydrophobia’ (Plymouth 1812); ‘American Modern Practice’ (Boston 1817); ‘Practical Treatise on the Management of Pox’ (1820); ‘American Medical Biography’ (2 vols. 1828); ‘Essay on Demonology, Ghosts, Apparitions and Popular Superstitions’ (1831); ‘History of the Town of Plymouth’ (1832); ‘Observations Relative to the Execution of Major John André as a Spy’ (1834).

THACHER, John Boyd, American writer: b. Ballston, Saratoga County, N. Y., 11 Sept. 1847; d. 1909. He was graduated from Williams College in 1869, and was a New York State senator 1884–85, and mayor of Albany, N. Y., 1886, 1897. He was an officer of the World’s Columbian Exposition and became chief of its bureau of awards. His publications include ‘The Continent of America, Its Discovery and Its Baptism’ (1846); ‘Charlecote—Or the Trial of William Shakespeare’ (1860); ‘Little Speeches: Awards’; ‘Christopher Columbus, His Life, His Work, His Remains’ (3 vols., 1903–04); ‘Outlines of the French Revolution Told in Autographs’ (1905), etc.

THACHER, Thomas Anthony, American educator: b. Hartford, Conn., 11 Jan. 1815; d. New Haven, Conn., 11 April 1886. He was graduated from Yale College in 1835 and for three years taught in Connecticut and Georgia schools. In 1838 he became a tutor in Yale where he was chosen as professor of Latin in 1842 which position he retained until his death. During a sojourn in Germany he taught English to the Crown Prince of Prussia and to his cousin Prince Frederick Charles. Returning to Yale in 1845 he became active in college work and an important member of the faculty. He was famed as a classical scholar and wrote frequently on his specialty for various periodicals. He assisted in the compilation of Webster’s dictionary and edited many Latin classics, notably Cicero’s ‘De officiis’ which he annotated (New York 1850). He also translated Medicus’ ‘Latin Grammar’ and wrote a ‘Sketch of the Life of Edward T. Herrick’ (New Haven 1882).

THACKERAY, William Makepeace, English novelist: b. Calcutta, 18 July 1811; d. London 24 Dec. 1863. His father, Richmond Thackeray, N. Y., 1807–1846, was a financier and brother of Matthew Arnold. He was the author of ‘Dawn in India’, a book of a good Yorkshire poetic. His mother was Anne Becher, a Calcutta lady whose family was a family well known in the ecclesiastical scene. Richmond Thackeray died in 1836, and his widow continued with his mother for a year and was then sent to England to be educated. Five years after his mother, who had married Mr. Carmichael Smyth, came to England with second husband. Thackeray’s relations both were in later years exceedingly charmed. The little boy, who during his voyage was at sea, was brought up by his mother’s stepfather, who was a sergeant in the Royal Artillery. He was put to school under a Dr. Cunnington where he is said to have got hints for the writing of ‘Vanity Fair,’ and in 1822 he entered at the famous Charterhouse. He remained six years, imbuing loyalty of memory of such former scholars as A. and Steele, watching and engaging in such as he described later—in one of his old friends, George Stow Venables, who was growing his great height of six feet, three in reading and writing poetry, devouring and making sketches—in short, doing things but grounding himself in the classics. His schoolmaster wanted him to do. As he was a good Horatian, he remained a strictly modern spirit.

After studying at a little under his s and perhaps, having some of the c described in the early pages of ‘Pendennis’ went up to Cambridge and studied in Trinity College. Here he sat widely, particularly in the literature favorite 18th century; but he entered the regular academic routine parties in the society of such fellows as the Tennysons, Arthur Hallam, Str and R. C. Trench (q.v.). He also in hand at college journalism, writing p and other skits in the weekly Sab short, he went his own gilt, which was, but not injuriously, unsteady. He left bridge after two years of residence taking a degree.

He had already before his vacation been one to the charms of Paris, and a natural turn for art he had little inclina follow his relatives’ advice that he should law. His income from a fortune left father, perhaps £500 a year, was ample means, and he resolved to travel and st Continent. In 1830 he spent a summer in Weimar, where he saw Goethe and enough of the ways of natives and travel describe ‘Pumpernick’ in after in studies, whether of literature or o law, do not seem to have been exhaustive haunter.

By the close of 1831 he had returned land and began the study of law in the Temple. Trips to Cambridge, visits theatre, pipes with Alfred Tennyson and Edward Fitzgerald (q.v.) in February 1832 to have distracted his attention from stone, but the Temple itself impressed every reader of ‘Pendennis’ knows. I did some electioneering for his friend, Buller, and formed an acquaintance with interesting writer, William Maginn, which probably led later to his introduce the group of men who were making ‘Magazine’ popular. When he came of end his law books and spent so much of Paris he did, remained with his mother for a year and was then sent
ndard. He soon bought it and tried to act as its correspondent in Paris. His stories and reviews, which in review were unnecessarily exhumed, proved unsuccessful, and Thackeray lost money by it as well as by and by gambling (he had met some success). He seems to have felt seriously to make his living. He had a turn for drawing, inherited from his father, and he detested life of an artist in Paris would ruin him. Accordingly in 1834 he settled in that city, and although of great skill in his new profession, he went to an establishment with a view to good use in his book and in ‘Philip.’ He had begun his contributions to *Azine* by 1835, if indeed he did so in August and September, as Bulwer’s ‘Eugene Aram’(which has been so much admired by Catherine) and ‘Barry Lyndon,’ he was working on a Paris newspaper in conjunction with his task as a correspondent, a task which did not always go well. The first separate publication, the eight pages entitled ‘Flore et Zéphyre’ as Paris correspondent once more, have been published in *The Constitutional*, which did not last. Thackeray, who had previously attempted to start a newspaper of his own to have begun his contributions to *Azine *by 1835, if indeed he did so in August and September, as *Bulwer’s* ‘Eugene Aram’ was a great success. He had the task of being a correspondent in Paris, where he had been stationed before. *The Constitutional* had its misprints in the first issue, but here his rashes and his enough ever after in support of children to be absorbed from all thence to have gone to London, first daughter (afterward Mrs. ) was born. He reviewed books and contributed articles and stories, and other magazines, without much success. His name was not much known, though he was a regularer in the latter year was America, a country which appreciated his work. There was humor and satiric power in his stories, and a certain amount of literary respectability, though there were some authors like Bulwer that were less known than his. *Catherine,* which finished its *Azine,* in February 1840, and ought to have shown contemporary how well his author knew the 19th century and could follow the lead of Fielding, the two volumes of the *Paris Sketch Book* (1840), and the abruptly ended *Shabby Genteel Story,* the germ of *Philip,* were all creditable to *Mr. Michael Angelo Titmarsh,* as Thackeray had begun to sign himself, but were not yet unmistakable products of a mature genius.

*A Shabby Genteel Story* was cut short by the severe illness of Mrs. Thackeray, which followed the birth of her third daughter, later Mrs. Leslie Stephen. On returning from a trip to Belgium her husband found her strangely changed in mind. There were hopes that she might recover, and Thackeray gave her very constant attention, at home, in Ireland and on the Continent; but it was of no avail. She was finally placed with a kind family and survived her husband about 30 years. The two little girls, for one daughter had died in infancy (cf. *The Great Hoggarty Diamond,* 1841) were sent to his mother in Paris, and Thackeray set about making himself to work all the harder for the sake of his wife. He might ensure their support and that of his wife, should his own life be cut short. He had no thought of freeing himself by law, and, although suffering deeply as such a tender-hearted man was bound to do, he went about his work cheerfully, solacing himself as well as he could with club life and enjoying Bohemian haunts such as the *Cave of Harmony,* described in *The Newcomes.*

In 1841 he published his interesting small volume *The Second Funeral of Napoleon* and collected his *Comic Tales and Sketches,* unsuccessfully in both cases. In 1842 he made a tour of Ireland, which yielded materials for his *Irish Sketch Book* of 1843, and also for a much better book finished at Malta in 1844 at the end of the voyage to the East described in *Notes of a Journey from Cornhill to Grand Cairo* (1846). This better book was a story which has never been widely popular, but which competent judges have pronounced to be the best of Thackeray’s works. *TheLuck of Barry Lyndon.* It was published in *fraser’s* in 1844 and did not meet with enough favor to warrant its being put between covers until 1856, long after its author had become famous, when it appeared in the third volume of *Miscellaneous* in Prose and Verse. The public has never liked a villain for a hero and is uncomfortable in the presence of a writer with a genius for irony, hence Thackeray’s masterly memoir of an irrepressible Irish rascal, although it gives a brilliant picture of European life, even in the 18th century and is perhaps inferior only to *Jonathan Wild,* a piece of sustained irony, will probably continue to be praised by the critics and eschewed by the general reader.

Meanwhile Thackeray had formed a connection that gave him not only a reliable source of income, but also an organ in which he could publish anything he cared to draw or write, with the result that his creative faculty was stimulated and made copious. From June 1842 until 1851 he was one of the most important members of the staff of *Punch,* which had begun its career in July 1841. *Miss Tickleton’s Lectures on English History,* with which his contributions practically began, naturally fell rather
THACKERAY

that, but his copy improved, his sketches were generally appreciated and no one was more at home in the famous 'Punch' dinners, where the policy of the journal was shaped. His first great success was made with 'Jeames's Diary,' November 1845. This satire on railway-stock gambling was followed by the famous 'Snobs of England, by One of Themselves,' which began on 28 Feb. 1846 and ran for a year. Thackeray discovered snobs in altogether too many quarters, perhaps, and he has been accused of overlooking one at home; but it was only natural that he should wish to make good to the point of exhaustion and some of his papers were very clever. Most of them were reprinted as 'The Book of Snobs' in 1848. His next series, to-day more attractive to some readers, was his 'Prize Novelist,' excellent burlesques, which ran from April to October 1847, and took off, without malice and with very great cleverness, such popular writers as Bulwer, Disraeli, G. P. R. James, Lever and Cooper. One, 'Crimoline, by Jeames's II—sh, Esq.' was a target of Dickens and Lever. These were only the leading things he contributed to 'Punch.' Probably they are not so attractive to many readers to-day as some of his ballads and songs — particularly such a perfect piece of occasional poetry as 'The Cane-Bottomed Chair.'

His increasing success enabled him in 1846 to take a house and bring his daughters back from Paris to a home of their own. In this house, 13 Young street, he wrote 'Vanity Fair,' which was published, as the fashion then was, in monthly parts. In January 1847, it began to appear in illustrated pamphlets issued by the publishers of 'Punch,' and it ran till July 1848, when a double number was given. This method of publication was bad, because it did not force the author to complete his work and thus get the opportunity to see and criticize it as a whole before committing himself to type. It conducd also to spasmatic writing and to padding. Most of Thackeray's longer stories show the evil effects of the part-system, and so do the novels of Dickens and Lytton.

At first 'Vanity Fair' did not greatly attract the public, although now the opening chapters that introduce Becky Sharp are usually found very interesting. Contemporaries, of course, could have no idea that she was destined to become one of the great heroines of fiction, and they knew Thackeray, not as a distinguished novelist, but as a clever satirist and burlesquer and draftsman. Before 1848, however, readers were awake to the fact that they had another great novelist in their midst. Charlotte Bronte and the Edinburgh Review acclaimed him, and he became something of a literary lion. To this day 'Vanity Fair' is regarded by many people as his most important work, and his most artistic work, and readers still divide into partisans of Dickens and of Thackeray, the latter usually winning the suffrages of the more critical.

Meanwhile Thackeray, again rivalry of Dickens, his rivalry was of the freindliest kind since he had published several Christmas books: 'Mrs. Emm's Ball' (December 1846) the success of which he said to have helped 'Vanity Fair,' 'Our Street' (1847), 'Our Birch and His Young Friends' (1848), 'Rebecca and Rowena' (1849), the clever but perhaps superfluous upon 'Ivanhoe,' and 'The Trickle-bug's Rhine' (1850), which was attacked by 'The Times' and effectively defended in a pret to the second edition.

In November 1848 the first part of 'Pendennis' appeared. It was not concluded till December 1850, owing to a severe illness. Thackeray had in the autumn of 1849, in most autobiographical of his novels, and ingenuity has been displayed in discovering supposed originals of his characters for example, is thought to have been suggested in Captain Shandon. It is more as that 'Pendennis' is an effective copy of a literary life in London in Thackeray's way, that he had no intention of running down brother authors, as some critics accused of doing. With all its merits, 'Pendennis' suffers, as do 'Vanity Fair,' 'The Virginians,' from its long length.

Efforts had been made to supply 'Punch' with a permanent, definite income by him an appointment as a director of the postal service; but his well-meaning friends failed. In 1851, disliking the stand taken by 'Punch' against Napoleon III, he resigned the staff. Although he still continued to contribute, it seemed advisable to secure another source of income. This he found in lecturing. In May and June 1851 he delivered six lectures before distinguished audiences in London, on his favorite humorists of the century. They were successful when delivered, and, in their collected form, rank high among his works, for their clarity and their rare sympathy. They were sequently delivered in other places in Britain, and then, on 30 Oct. 1852, the sailed (in company with A. H. Clough and James Russell Lowell) to deliver America. Just as he was starting he received a copy of the novel he had been working months, reading in the British Museum, materials and laboring carefully upon his 'The History of Henry Esmond, Esq,' published in parts, and hence is the most of Thackeray's novels, with the exception of 'Barry Lyndon.' Its salutary study of character, its nice balancing of romantic realism that accompanies a minute of a period such as Thackeray possessess 18th century and particularly of the Queen Anne, its attractive though per what over-laborious style, and above all the pervading atmosphere of tender sentiment, made it not only a classic historical but the favorite book of many Thackeray, whom it is idle to point out that perhaps novel is after all masterly tour-de-force the essential vigor of Thackeray's get better displayed in the superb irony of 'Lyndon' and in the unfinching port human vices and follies that makes Fair memorable.

In America Thackeray was most received, and by his genial manners by many friends. He lectured in the cities of North and South and sailed for 1853, much richer in purse ($20,000) nately he did not attempt to travel to
account by writing a book upon it, as had done years before.

Next two years were spent in good part came to him in Switzerland, and during stayed in Rome, where he had a bad of fever, he wrote that charming bur- for children. 'The Rose and the Ring', for which he was made a fellow of his ful old child-fig-ure, Colonel Newcome, ublished in monthly parts from October 1855 inclusive; and is said to etted Thackeray £4,000. The spasmodic influence of polished style, but Thackeray's satiric power and his ing mellowness of sentiment were ex- y blended, and the book may fairly be a masterly presentation of domestic life. a character of Colonel Newcome, who has the traits of Thackeray's stepfather, is late critics to be grossly exaggerated. ngrily idealized, would seem a better in view of the appeal the old man has made still makes to thousands of hearts. October 1855 Thackeray again sailed to ted States, where he again remained he following April, lecturing on 'The forges' with great success and repeated ess, The English Humorists.' In he delivered the 'Georges' throughout d and Scotland, and enjoyed the society children and his numerous friends, mak- er lives bright, although his own was rotclouded by the precarious state of his. In July 1857 he stood as the Liberal for Parliament from Oxford and was d by a small majority, accepting his dis- ment gracefully. In November 1857 he quel to 'Esmond,' for which he had d material in America, the only partially ful Virginians,' began to appear and course in monthly numbers until Octo- . It was at least a notable link between ther and the daughter country and, al- it shows plainly the effects of Thack- ing; especially still for it, it probably s more praise than it usually receives, his time one of the most unpleasant in- in Thackeray's life occurred. Edmund (q.v.), a rising journalist, published in 1838 a sketch of Thackeray that was not per pleasing to the latter. Thackeray re- a stinging letter; Dickens was unfor- drawn into the affair on Yates' side; ray laid the correspondence before the te of the Garrick Club; the committee club took it too seriously; and Yates, g to apologize, was dropped from the Dickens seems to have been in the right, ray unintentionally in the wrong. ion between the two ensued; fortunately days before Thackeray's death, they met lent and shook hands spontaneously.

1860 a long-cherished desire of Thack- was fulfilled. His publishers, Smith and began to issue The Cornhill Magazine ary, and made him editor. The first had an enormous sale and he was as- as a boy. He secured Anthony Trol- other good contributors, but for his was forced to content himself with 'The Sketches by ' 'The Old Curiosity Shop, the work of a historical romance of the age of Henry ut which he had dreamed. Neither

'Philip' (1861, 1862) nor 'Lovel the Widow's (1860, 1861) was altogether worthy of his genius, but the delightful essays known as 'Roundabout Papers' (collected, 1863,) and to a less extent 'The Four Georges' (not reprinted until they appeared in the Collected Works, 1867-69) surely were. Thackeray soon found the cares of editorship — especially the duty of refusing contributions from eminent writer like Mrs. Browning, too onerous, and he was too old to become methodical; so he resigned in April 1862. His health steadily declined — though one finds little trace of the fact in the admirable chapters of 'Dennis Duval' (1867), which was running in The Cornhill at the time of his death. In November 1862 he was seriously ill. With his white hair he passed for an old man, although he was about 52½ years on that fatal night of 23 Dec. 1863, when he went early to bed without suspecting that death was so near. An effusion of blood took place in his brain, and he was found dead in the morning. On 30 Dec. 1863 he was buried simply at Kensal Green.

Thackeray, as has been said, was very tall — a colossal infant, Molley called him, with white, shiny, ringletty hair . . . a roundish face and a little dab of a nose upon which it is a perpetual wonder how he keeps his spec- tacles. He was as attractive to his friends as he still is to the admirers of his genius. Per- he was too much of a Bohemian in some respects, but as a father and a genial, kind- hearted man it would be hard to name any- erior. As a man of letters his rank is, of course, very high. Besides being one of the chief of English novelists, he was a draftsman of ability, though not of genius, an excellent writer of society and satiric verse, an eminent lecturer, a charming letter writer, one of the best of the English essayists, a born provider of burlesques and comic skits for the public of his day — in brief, he was an author of varied and copious genius, a master of humor, of satire, and of sentiment, and in addition he was es- tuted though by no means small intellectual powers and an admirable stylist. Unfortunately the task of appraising the value of his work has been rendered difficult by the extravagant wor- ship of his partisans. Many of the volumes that have been added to his works since his death represent merely his talents as a journal- ist, not his genius as a writer, and even his best books are often defective in structure or in strength. We are still too near him to be able to tell whether he will finally outrank Dickens as a creative force in literature or whether he will rank with Fielding as a portrayer of char- acters and manners. We are not too near to perceive that he is not so important in the evolution of fiction or so cosmopolitan and heroic a figure as Sir Walter Scott. But his place is certainly with this small group of illustrious novelists. See BARRY LYNDON; HENRY ESMOND; NEWCOMES, THE; PENDENNIS; VANITY FAIR.

Bibliography.—Thackeray's works have appeared in many editions — notably that of 1883-84 in 26 volumes, and the 'Biographical Edition,' with valuable introductions of Mrs. Ritchie. The Thackeray revival occurred after the publication of Mrs. Ritchie's edition — editions being
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superintended by Mr. Lewis Melville (important for completeness, faithfulness to the original, bibliographical and historical information), by Mr. Walter Jerrold, and by W. P. Trent and J. B. Henneman (the Cornhill Edition, 1904, 30 vols., with introductions and bibliography). The chief lives of Thackeray are those by Anthony Trollope ('English Men of Letters,' 1879), by Henry Merivale and F. T. Marzials ('Great Writers,' 1891), by Lewis Melville (2 vols., 1899) and by Charles Whibley (1903). There are numerous volumes of Thackerayana and separate reprints of early works, as well as several special bibliographies, such as M. H. Spielmann's 'The Hitherto Unidentified Contributions of W. M. Thackeray to Punch' (1900). His correspondence with the Brookfields was collected in 1887. Consult also the article by Leslie Stephen in the Dictionary of National Biography, and for criticism, W. C. Brownell's essay in 'Victorian Prosse Masters' (New York 1901); Benjamin, L. S., Some Aspects of Thackeray' (Boston 1911). William P. Trent, Professor of English Literature, Columbia University.

THAI, an East Indian word meaning "free," and the general designation of certain peoples of Farther India, including the Thos, Muonges, Shan, Laotians and Siamese. Although widely diverging in certain characteristics, they speak languages derived from the same stock, and are evidently of common descent. The Siamese, the best known and most civilized of the Thai group, are considerably mixed with Malays, Hindus and other races, and are of medium stature and broad-headed. The Laotians are shorter in stature than the Siamese, and their skulls are less distinctly of the broad-headed type. Consult Dignon, 'Etude de la Langue Tai' (Paris 1886). See Laos; Shan States; Siam.

THAIS, thā'īs, a Greek hetaera; b. at Athens, who accompanied Alexander the Great on his expedition to Asia. She is said to have instigated Alexander to set fire to the citadel of Persepolis, the residence of the Persian kings, in punishment for the injuries done to her native city by Xerxes; but this anecdote, though immortalized by Dryden, is probably untrue, as we know on the authority of Arrian that it was his intention to sack the place and burn the citadel on grounds of state policy. After the death of Alexander, Thais became the mistress of Proknei Lici, and, according to Athenaeus, was afterward married to him. She was celebrated for wit and repartee, and many anecdotes are recorded of her talent.

THALBERG, tālˈbərk, Sigismund, Swiss pianist; b. Geneva, 7 Jan 1812; d. Naples, 27 April 1871. He was the natural son of Prince Moritz Dietrichstein and Baroness von Witzlar. He studied piano playing. At 14 he was an accomplished pianist. In 1830 he made his first concert tour, which included a visit to England, Holland, Scandinavia, and Spain, while in 1855-56 he visited South America and the United States. His playing was notable for its beauty of tone and the charm of its bearing, rather than for brilliancy or fire. To himself belong certain innovations in playing, accepted as a mark of his prominence though not original with him; such for instance as that of playing the cantilena in staccato notes by the thumbs, while the rapid hand plays arpeggios or octave above and below them.
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id chambers. To obtain metallic thallium this flue dust, it is dissolved in dilute ric acid, filtered, and hydrochloric acid h. The slightly soluble thallium chloride ies. This is changed to the sulphate, d at the various elements accompanying m and the thallium sulphate decomposed trolysis or by action of zinc. Thallium, 1 Tl, has an atomic weight of 204.18, spe-gravity 11.19 and fuses at 561° F. A cut surface has a brilliant silver white which is quickly lost by the oxidizing of the air. It is softer than lead and is ble. The metal dissolves readily in sul- or nitric acids, but only slightly in hloric acid. It forms two classes of unds: the thallous compounds derived he oxide TlO, and the thallic compounds TlOi. The salts of the first class re: the corresponding salts of potassium odium. The chloride, however, resem- rose of silver and lead in its insolubility ter. Thallium compounds are used in a:ferred to a non-luminous name. They are very ous, resembling lead in physiological ac Thallium and its compounds are used in nanure of thallium glass, the high fice power of which makes it valuable in the preparation of optical instruments and ficial gems.

[ALLOPHYTA. See BOTANY; PALEO-

[ALWEG, the lowest line of any val drainage course. In valleys with rivers, the natural ion course, in dry valleys it gully through which storm waters run off.

[AMES, têmz. Canada, a river in the eastern part of Ontario, rising in Perth and flowing southwest, 160 miles, into Saint Clair, about 30 miles east of De-Mich. It is navigable, 18 miles to Chat-ty boats of considerable size, but has a bar at the mouth. On the banks of river, about 30 miles above Chatham, a band was made by General Proctor and, when pursued by General Harrison in the pursuit of this band the position chosen was und very favorable to the American ad-

On 5 Oct. 1813 Harrison with 3,000 attacked and by a vigorous charge of cav-nder Colonel Johnson drove the British at confusion from the field. Tecumseh and General Proctor himself barely d capture. The Americans lost 47 and itish 48, besides 33 Indians; 477 prisoners aupted. The results of the battle were: dian Northwestern Confederacy was de-; the British power in Upper Canada roken and practically all that had been the Americans at Detroit was regained.

[AMES, thâmz, Conn., a river in the estern part of the State, formed by the m of the Quinehaug, Shetucket and Yan ers at Norwich, whence it flows south 15 miles to the Long Island Sound. ts mouth on the right bank lies the city w London. It is really a tidal estuary, and beautiful waterway navigable for vessels to its head, and an important ave local commerce.

[AMES, têmz. England, the most import- famous river in Great Britain, rising in Gloucestershire, and flowing in an irregular eastward course into the North Sea. It separ- rates the counties of Gloucester, Oxford, Buckingham, Middlesex and Essex on the north from Wilts, Berks, Surrey and Kent on the south. Its total length, measured from the Nore Light, is 217 miles, of which 180 miles are navigable. The upper waters around Oxf ord are known to the poets as Isis. The river passes the cities of Oxford, Reading, Maidenhead, Windsor, Chertsey, Kingston, and passes through the heart of London. Below London it widens gradually into an estuary, which, at the mouth, is 27 miles wide. The river is navi- gable for the largest vessels up to the east end of London, where the great Victoria, Albert and West India docks have been constructed. The upper course is connected by an extensive canal system with the Severn River and the middle counties. Pike, perch, roach, dace and other fish are caught in quantities. The surface of the Thames from Oxford is largely taken up by pleasure boats and regattas, the weather, and the regattas held then are world famous. The Medway is the largest tributary. The Cherwell flows in at historic Oxford 112 miles up stream; the Pang flows in at Pangbourne 51 miles from London. The Basset net at Reading, six miles farther down. The water supply of London is taken mainly from the Thames. The natural flow is about 350,000,000 gallons a day, and the water companies take about 130,000,000 of this. Naturally the utmost care is taken to preserve the water from pollution by sewage. In passing through Lon don the water front of the river is vastly increased by the method of constructing docks cut out in rectangles from the land. In no other way could the 40 miles of water front be made to serve the enormous business of London.

THAMES, Battle of, in the War of 1812. On 12 Sept. 1813 General Harrison, who was still at Seneca on the Sandusky River (see FRENCHTOWN, BATTLE OF), received word of Perry's victory on Lake Erie (see ERIE, LAKE, BATTLE OF; PERRY, O. H.) and began to prepare for his campaign against Detroit. By dint of hard work Harrison recruited his army to 6,500 troops, commanded by Brig.-Gen. Dun can McArthur and Lewis Cass. Lieut.-Col. James V. Ball, Gov. Isaac Shelby of Kentucky and Col. Richard M. Johnson (qq.v.). At Malden and Detroit Proctor had 983 British regulars and at Amherstburg were 2,500 In dians, but when Harrison landed at Middle Sister Island, Proctor burned the public property at Detroit, and on 24 September withdrew to Sandwich. Three days later Harrison occupied Malden, then entered Sandwich, Proctor having evacuated, and began to pursue the British, who, on 5 October made a stand on the Thames River, a mile from the Moravian town and about 30 miles above Chatham. The British formed with their left near the road to Detroit, and their reserve with a six pounder between the road and the river, while the Indians were on the right near a swamp. Harrison divided his troops as follows: Gen. George Trotter's brigade of 500 men in front, with right on the road and left on the swamp; Gen. John E. King's brigade 150 yards to the rear; and sup
thanatopsis—a view of death), the earliest American poem to present a thoroughly noble thought in a thoroughly noble form, was written by William Cullen Bryant—then about 16—in 1810, published, without the poet's knowledge, in the North American Review in 1817 and greatly revised for Bryant's Poems of 1821. From the first it was regarded as a masterpiece, and it speedily won a hold upon the popular mind which has hardly been surpassed by that of any other serious native poem. Without question, the large, simple idea of the piece has had much to do with its fame. There is consolation for most human beings in the reflection that death, though unavoidable, is also common to all, and that the whole of mankind—spiritual or sensual—eventually lies in the splendid earth. Perhaps Bryant's answer to the question which had been tormenting him—How can one be reconciled to death, more pithy, than many of his readers have suspected? he offers no promise of immortality and refers to no deity higher than nature. But the sincerity and eloquence of "a view of death" lift it above argument. Its largeness and harmonious, its fiction universal, its images—drawn from the American landscape—magnificently, on a blank verse stately, its rhythms in unison and with its swelling emotions is the distilled essence of late Puritan poetry, as the Puritans had been the thought of death, and yet so far from their particular doctrines and biases as to be able to utter a universal thought in universal terms.

THANE, the name of an ancient title among the English or Anglo-Saxons. A man not noble was raised to the rank of thane by acquiring a certain portion of five hides for a lesser thane), by a man at sea or by receiving a manor of land, whether connected with the personal service of the king or only on the condition of residence in the thane's district or administration of justice, were entered to the thane's land, where the landed property guaranteed for his conduct. The thanes were the predecessors of the barons.

THANKSGIVING DAY, an annual festival of thanksgiving for the mercies of the closing year, fixed by proclamation of the President of the United States. The President's proclamation makes the day a legal holiday in the United States, where it ranks as the most solemnly observed festival, taking the place which has been nearly universally observed—than that of Christmas. The annual celebration of Thanksgiving in America was kept by the Pilgrims at Plymouth in 1621 and repeated often during that and the following century. Congress recommended the observance annually, and the Presidents have always issued proclamations appointing the last Thursday in November as Thanksgiving Day.
of Maderia, with a thick umbrella, or palm-like, crown of finely-cut foliage three or four feet across.

THASO, tha’so̅, or THASOS, an island at the northern end of the Ægean Sea, off the coast of Macedonia. Its area is 167 square miles. It is nearly round and about 16 miles in diameter. Excepting some low strips along the shore adapted to agriculture, it is covered by thickly wooded mountains, which in ancient times yielded gold and marble. The forests contain wool valuable for shipbuilding. Corn, fruit, oil and wine are produced; wax, honey and a superior marble are exported. It was settled by the Greeks about 700 B.C. About 463 B.C. Athenians captured the city, razed the walls and took away the shipping. The Romans freed the territory after the battle of Cynoscephalae, 197 B.C. The Phoenicians were attracted to the island at an early epoch by the gold-mines; and an Ionic colony settled there in 8 A.D. The island since then has changed hands several times and now has an Egyptian ruler. The capital, ruins of which are still to be seen, was on the northern coast, on the site of the present landing-place of Limena. The products yielded gold and marble. The forests are divided through villages and totals about 12,000.

THATCHER, thäch’er, Henry Knox, American naval officer: b. Thomaston, Me., 26 May 1806; d. Boston, Mass., 5 April 1880. In 1823 he entered the navy as midshipman and became a lieutenant 1833. In both attacks on Peking he commanded the first division of Commodore Porter's fleet. After the Civil War he commanded the Gulf squadron until 1866 and the squadron of the Pacific from 1866-68. He was made rear-admiral in 1866 and in 1868.

THAUN, or THAON, Philippe de, early Anglo-Norman poet: b. probably near Caen, France, about 1100. He wrote a versified ecclesiastical calendar known as 'Li Cumpoz' and his is the earliest work of this period (about 1115) that is known. His most important work was written about 10 years later and is known as 'Li Bestiare' or 'Physiologus.' This also was in rhymed and but one copy is known. In it the creatures are grouped and treated symbolically. The manuscript was dedicated to Adelaide, queen of Henry I, and the work is valued chiefly as a linguistic relic. Consult Walberg's 'La Bestiare de Philippe de Thaun' (Paris 1900).

THAW CASE, a criminal trial noted in legal annals as 'the most notorious case in the recent history of American criminal law.' Harry Kendall Thaw, son of a distinguished and wealthy Pittsburgh, Pa., family, 25 June 1906, shot and killed Stanford White, a distinguished architect, in the roof garden of Madison Square Theatre, New York, of murder was in outcome of Thaw's marriage to Evelyn Nesbit, an artist's model and actress, who accused White of abusing her. A long-drawn-out trial resulted, notable for Thaw's plea of insanity, his escape from Matteawan State Hospital for the Insane, his flight into Canada, his ejection from the country and subsequent arrest in New Hampshire and repeated trials following. In the original trial Thaw was sent to Matteawan, 1 Feb. 1906, and was kept there until 17 Aug. 1913, when he escaped by alleged conspiracy with his keepers, an escape which lawyers were concerned. Thaw finally was brought back to New York State, indicted for conspiracy and acquitted. Later he was declared sane and taken to his Pennsylvania home where he remained because of the refusal of the local authorities to agree to his extradition.

THAXTER, thäch'ter, Celia Laitghon, American poet: b. Portsmouth, N. H., 29 June 1835; d. island of Applethorpe, Isles of Shoals, 26 Aug. 1894. She spent her childhood and much of her later life at the Isles of Shoals. In 1851 she was married to Levi Lincoln Thaxter, who was accustomed to visit the island long before they had become a popular summer resort. Her first published poem, 'Landlocked,' was printed by Lowell in the Atlantic. The motive of subsequent verse is also generally the sea and coast scenery, though the arts, particularly music, claimed some of her attention. Its note is one of much original power. Her works are 'Poems' (1872); 'Among the Isles of Shoals,' prose sketches (1873);' Poems' (1874); 'Drift Weeds' (1879); 'Poems for Children' (1884); 'The Cottage Mystery' (1886); 'Idyls and Pastorals' (1886); 'The Yule Log' (1889); 'An Island Garden,' a prose diary (1894); 'Letters' (1895); 'Stories and Poems for Children' (1895). A collected edition of the 'Poems' appeared in 1896. Consult the 'Letters'; also an article in the New England Magazine (Vol. 24, pp. 166-72).

THAXTER, Roland, American botanist: b. Newton, Mass., 28 Aug. 1858. After receiving a Harvard education and securing his Ph.D. there, in 1888 he became a professor of biology and botany in the university and a noted authority on the fungus diseases and on cryptogamic botany. From 1885 to 1891 he was expert mycologist of the Connecticut Agricultural Experiment Station. He was chosen American editor of the British 'Annals of Botany,' elected president of the American Botanical Society and in 1912 made a member of the National Academy of Science. He has contributed to many scientific publications dealing with his specialties.

THAYER, thär, Abbott Handerson, American figure painter, who also has painted animals and landscapes; b. Boston, 12 Aug. 1849. He was a student at the École des Beaux Arts under Lehman and Gérôme from 1875 to 1879. Upon his return to America he was made president of the Society of American Artists. He was the discoverer in 1894 of the Laws which underlie Concealing Coloration; and published in 1909 'Concealing Coloration in the Animal Kingdom' (written by his son, Gerald H. Thayer). He is a member of the National Academy of Design, of the American Academy of Arts and Letters and of the L'Insigne Reale Accademia Romana delle Belle Arti Denominata di San Luca. Among his popular works are 'A Young Woman' (in the Metropolitan Museum, New York); 'A Virgin' (National Gallery, Washington, D. C.); 'Woman in a Figure' (Albright Gallery, Buffalo); and 'Caritas' (in the Boston Museum).

1817; d. Trieste, Austria, 15 July 1897. He was graduated from Harvard in 1843 and from the Law School in 1848. For a time he was assistant in the Harvard Library, and while there determined to write a life of Beethoven. In 1849 he went to Europe to collect material for this work and lived abroad the greater part of his life. In 1859—62 he was United States consul at Trieste, Austria, and after that devoted himself entirely to his literary work. The first volume of his ‘Life of Beethoven’ appeared in 1860; the second in 1872; the third in 1879 and the fourth was nearly completed at the time of his death; it was published in German, although originally written in English. It deals with the life and character of the man Beethoven rather than with his musical work; and is very detailed, exact and impartial. Thayer also wrote ‘Signor Masoni’ (1862), and ‘The Hebrews and the Red Sea’ (1865).

THAYER, Benjamin Bowditch, American mining engineer; b. San Francisco, Cal., 20 Oct. 1852. He was educated in the Harvard Scientific School and on graduating in 1883 at once began active work in connection with the Anaconda Copper Company, of which he became president. He later was made vice-president of the Amalgamated Company which absorbed it. He was president of the American Institute of Mining Engineers in 1914 and the following year was named on the United States Naval Consulting Board, where he did much good work.

THAYER, Eli, American educator and inventor; b. Mendon, Mass., 11 June 1819; d. Worcester, Mass., 15 April 1899. He was graduated from Brown University in 1845; became principal of the Worcester Academy; and in 1848 founded The Oread, an institute for young ladies in Worcester. He was a member of the State legislature, 1853–54, and of Congress, 1855–61, and conducted an ‘Emigrant Aid Company’ which settled portions of Kansas on the anti-slavery basis. Subsequently he acquired manufacturing interests in Massachusetts and received patents for a section safety system, called a ‘jelly brake’, which was made into a hydraulic elevator. Besides his Congressional speeches (1860), he published a volume of ‘Lectures’ (1886), and ‘The History of the Kansas Crusade’ (1889).

THAYER, Ezra Ripley, American advocate and educator; b. Milton, Mass., 21 Feb. 1866; d. September 1915. He took his LL.B. degree at Harvard in 1891 and was admitted to the bar in Boston directly afterward. His progress was rapid and he became Dane professor of law at the university and dean of the Law School. He was a member of a noted firm of attorneys and was particularly interested in raising the standards of his profession.

THAYER, James Bradley, American author and lawyer; b. Haverhill, Mass., 15 Jan. 1831; d. Cambridge, Mass., 14 Feb. 1902. He was educated in local schools and graduated at Harvard in 1854. He began his prelegal life to teaching but after securing his LL.B. degree from the university in 1856 rose speedily in the law, to which he was admitted in that year. In 1873–75 he was Royal professor of law in Harvard and from 1881–92 held the chair of law professor. Iowa University gave him his LL.D. degree in 1891; Harvard in 1901. In 1861–65 he was secretary of the Loyal Publication Society, and was also fellow of the American Academy of Arts and Sciences and a member of the Massachusetts Historical Society. Besides many contributions to scientific publications he was author of ‘Letters of Chauncey Wright’ (1877); ‘A Western Journey with Emerson’ (1884); ‘Cases on Evidence’ (1892); ‘The Origin and Scope of the American Doctrine in Constitutional Law’ (1893); ‘The Teaching of English’ (2nd ed., 1893); ‘Inchindon’s Cases’ (1895); ‘Cases in Constitutional Law’ (2 vols., 1895); ‘The Development of Trial by Jury’ (1896); ‘Preliminary Treatise on Evidence at the Common Law’ (1898), etc.

THAYER, John Adams, American publisher; b. Boston, 20 Feb. 1861. He had a common school education in Cambridge and became a noted printer and typefounder. In various responsible capacities he was connected with such representative publications as the ‘Ladies’ Home Journal’, ‘Mansey’s Magazine’, the ‘Delineator’, etc. From the beginning in Paris from 1906 to 1911 he again became a publisher, notably to the ‘Smart Set Magazine’. His best known publication is ‘A Publisher’s Life Story’ (1910; rev. ed., 1912).

THAYER, John Milton, American soldier, lawyer and politician; b. Bellingham, Mass., 24 Jan. 1820; d. 1906. He graduated at Brown University in 1841 and became a member of the Massachusetts bar, removing in 1854 to Nebraska where he was made a member of the territorial legislature in 1860. Previous to entering on political life he was a territorial brigadier-general and fought successful Indian campaigns, placing the Pawnees on a reservation in 1859. In the Civil War he also was a brigadier-general and led a Nebraska regiment. For services at Vicksburg, he was brevetted major-general. Returning to Nebraska in 1865 he was elected to the United States Senate (1867) and afterward was appointed by Grant as governor of Wyoming Territory. In 1886 he was elected governor of Nebraska and also was made a member of the National Committee of the Grand Army of the Republic for the state. Brown University conferred on him the honorary A.M. degree in 1847 and the University of Nebraska gave him its LL.D. in 1902.

THAYER, Joseph Henry, American educator; b. Boston, Mass., 7 Nov. 1828; d. Cambridge, Mass., 26 Nov. 1901. He was graduated from Harvard in 1850, from Andover Theological Seminary in 1857, and was pastor of the Congregational Church at Salem, Mass., in 1859–64, being absent from his charge for nine months in 1862 when he served as a chaplain in the Union army. In 1864 he accepted the chair of sacred literature at Andover, which he resigned in 1882 to become professor of New Testament criticism at Harvard. He published ‘A Greek-English Lexicon of the New Testament’ (1885); ‘A Biography of John Cotton’ (1887); ‘A Biography of John Eliot’ (1894); ‘The Greek and English Bibles’ (1897); ‘The Change of Attitude Toward the Bible’ (1897); ‘Bibles and Their Use’ (1899); etc.

THAYER, Sylvanus, American soldier; b. Brantree, Mass., 9 June 1785; d. South Braintree, 7 Sept. 1852. He was graduated at Dartmouth in 1807, and at West Point in
For four years he was occupied, chiefly in Boston and New York, in the construction of coast-defenses. During the War of 1812 he served as chief engineer of the Northern Army on the Niagara frontier and at Lake Erie, as chief engineer and brigadier in the defense of Norfolk, Va. After a period of observation in Europe, where he visited the fortifications and military schools, he became superintendent at West Point, a position he held from 1819 to 1833. He was president of the board of engineers, and was in charge of the construction of roads and harbor improvements around Boston. In 1833 he was appointed arbitrator in a dispute between the city and the State of New Hampshire, and in 1833 he was appointed to the diplomatic service, first in Vienna, and then in St. Petersburg. In 1833 he was appointed to the diplomatic service, and in 1834 he was appointed to the Russian mission to St. Petersburg. He was the author of several medical and surgical works, notably "Lectures on Malarial Fever" (1897).

THAYER, William Sydney, American physician: b. Milton, Mass., 23 June 1864. He was graduated at Harvard in 1885 and took his degree as doctor of medicine there in 1889. He was for some time a member of the medical staff of the Johns Hopkins University and visiting physician at the hospital there. He is a member of several medical societies at home and abroad, and has made valuable researches in fever and was first to report the third heart sound at his clinics. In 1917 he was with the Russian mission to Petrograd. He is the author of several medical and surgical works, notably "Lectures on Malarial Fever" (1897).

THAYER SCHOOL OF CIVIL ENGINEERING, a department of Dartmouth College (q.v.).

THEAGENES (thē-gē'ē-nēz) AND CHARICLEA, καρίκλε'α, a Greek romance written by Heliodorus, bishop of Trikka, in the 4th century. The story recounts the love and adventures of Theagenes, a Thessalian and Chariclea, daughter of the queen of Ethiopia, and is the foundation of many later romances both by the early Greek fabulists and the later French novelists, including Achilles Tatius among the former, and Gombrerville, Scudéry and D'Urfé among the latter. It was translated into English by Thomas Underdown (1577), and into French by Jacques Amyot (1586).

THEATINES. See Orders, Religious.

THEATRE (Greek, a place for seeing, from θέα, to regard or look at), literally any building used for purposes of exhibition, but now generally applied to a place in which dramatic and musical performances are given. The theatre may be considered as a form of architecture which found its earliest expression in the classic ages of Greece and Rome, and after a long eclipse has again become important within the last 250 years. The term theatre also comprises the whole mass of dramatic literature and its theatrical representation. In this article it is proposed to deal (1) with the theatre as an architectural edifice from its earliest beginnings down to the present. For the treatment of the theatre as a form of artistic expression see Drama.

The Theatre in Architecture.—The theatre had its origin among the Greeks. Its germ was the ring in which dithyrambs and phallic songs were performed by choruses in honor of Dionysus. These were performed in an orchestra or circular dancing place, on all sides of which the spectators were ranged. Later a table was introduced, on which the leader of the chorus stood while he carried on a dialogue with the rest of the choristers. The use of the table was reserved for the choral odes. This table was the first and most rudimentary form of stage and the date of its introduction is about 500 B.C. Next an actor, a single actor, was introduced by Thespis and, as he played many different

(1917); 'Theodore Roosevelt' (1919). He is an overseer of Harvard College; vice-president American Historical Association; member National Institute of Arts and Letters; Fellow, American Academy of Arts and Letters; Fellow, American Academy of Arts and Sciences, and corresponding secretary, Massachusetts Historical Society.
parts, a tent had to be erected in which he should be able to change his mask and dress. Out of this tent arose ultimately the stage building on the Greeks, which even after they became elaborate structures of stone retained the name skênê, "tent or booth" (cf. English scene).

Greek Theatrical Architecture.—From the remains of various Greek theatres which have been excavated on the mainland and on Crete, at least in its main features, one of these edifices. In the centre the orchestra formed an exact circle in the middle of which stood the altar of Dionysus. Later the circle was cut on the side next the stage. Round the orchestra, in size rather more than a semi-circle, the seats for the audience rose tier upon tier like a modern baseball field stand. These seats were at first of wood, but owing to a collapse of the benches in 499 B.C., it was resolved at Athens to erect a permanent stone theatre. This was the theatre of Dionysus, which exists today, although it has been partly reconstructed. It consists of three parts—the orchestra, stage house and auditorium. The orchestra was occupied solely by the chorus. Behind it rose the stage buildings, usually a long, narrow rectangle, facing the audience; the most ancient one at Athens was 55 yards long and only 11 yards deep. But then little scenery was used. In front the buildings represented a palace or a temple. There were usually three doors opening on to the stage, which was a wooden platform, standing 8 or 10 feet above the orchestra. On it the actors appeared. The auditorium or building was intended to accommodate practically the whole population of the city in which it stood. The rows of seats in consequence were of enormous size, the theatre of Dionysus at Athens holding 27,500 persons, and that at Megalopolis being computed to seat 44,000. In order to obtain the necessary slope for the tiers of seats as well as a natural substructure for the same the Greeks always chose some natural hollow where the shape of the ground aided the design of the architect. Tiers of seats rose one above another, divided vertically by passages for access and in many cases horizontally also. The lowest or first row of seats at Athens is of marble, and was reserved for persons of distinction; the rest are of ordinary stone. Between the auditorium and the stage were the passages of entrance (parodoi) which in some instances were of great breadth. The back-wall was called the scena, the side-walls, or wings, in each of which was an entrance door being called paraskenia. The stage was called the proscenium. A flight of steps, later two, connected the stage with the orchestra and these steps, continued out of sight beneath the orchestra. The orchestra was covered by a curtain (aulistra) which was let down, not drawn up as is usual today. When the action of the play required a different scene, the back of the stage was covered with painted curtains or backdrops. At either end of the stage was a large rear stage, or acroterium, each side of which bore a different scene, thus providing three sets of wings. In dealing with the early Greek theatre it must always be remembered that the stage was only of secondary importance, the orchestra being the chief point of interest. There was a certain amount of machinery, of which the famous was a species of crane by which gods could be let down from on high or up again as occasion required. The Greek theatre was reconstructed at it was a species of religious other performances took place only on festival when the whole population turned out to witness them. The acoustic properties appear have received little attention. Actors used species of megaphone device, concealed in the masks, in order to make their voices carry a distance. Besides the theatre at Athens six theatres existed also at Epidaurus, Dyonysus and Megalopolis.

Roman Theatres.—The Roman theatre is largely founded on Greek models. It was before a permanent theatre was erected Rome because it was thought that such a display was not in harmony with the spirit of the republic. At an early period drama performances took place in temporary wo structures and amid such surroundings as comedies of Plautus and Terence were produced. Toward the close of the republic wooden theatres were erected in Rome. Pompey was the first to construct one. His theatre, which may be taken as the model, near the Campus Martius differs naturally from the Greek model. The stage was a semi-circle and there was no altar singing and dancing were transferred to the and the orchestra space was occupied by for prominent persons. The stage was large. The seats were built of masonry, not excavated out of a hill side or planted on a natural slope. The use of the arch and of concrete by Romans facilitated this mode of building under Roman hands the theatre first an architectural unit, with auditorium, stage and buildings all joined in a structure. There are extensive Roman theatres; among the most celebrated are those of Rome, Orange, France, Ephesus, Miletus, Cnidus, Taormina and Naxos. Roman theatres were frequently much larger than the Greek and there were frequent arrangements to protect the audience from the sun’s rays by an awning. The Roman theatre of the empire degenerated into sheer lasciviousness and the rise of Christianity brought a new and valuable foe to this kind of spectacle. The incensed against the public spectacles, clerics were forbidden to be present, gradually the new morality gained the theatre and the approach, which had been a feature of social life of the people.

Middle Ages.—During this period the market plays and was under the mantle of the Church theatre not. Plays were presented generally in c or monasteries, and the most elaborate used was a three-story scaffold representing heaven, earth and hell. Strolling players gave performances in temporary huts period in, therefore, entirely lost gards theatrical architecture.
Theatre to the Present.—With the Renaissance in the 16th century also a revival of the drama, and theatres to be built. The earliest was probably a house of some sort in the Hôtel de Cluny, Paris, which was built about 1548 as a Fraternity of that Passion. The earliest and perhaps the most celebrated was that which Bramante designed at Rome in the Grand Court of the Vatican about 1580. Then came the Teatro di San Carlo at Naples, designed by Palladio, and in 1584; while the earliest theatre built in England was constructed by Alcotti at Oxford in 1618. In all the early Continental theatres, the construction was founded on models, but in England a simpler idea prevailed: the stage was erected for theatricals. This was the Theatre, built by Inigo Jones for the Duke of Chesterfield and erected in London in 1613. The stage was in the open air, and the spectators stood or sat in the yard called the yard), while all round it ran galleries or boxes (then called rooms) like the galleries of an inn. There was provision for scenery. The door at the rear of the stage, which communicated with the dressing-rooms, etc., and was the general entrance for the actors, was hung with curtains, and some distance up the stage, which was drawn and undrawn to indicate an apartment, but the locality in which the actors were playing, was indicated by a placard hung on the wall. This was called a forest. Properties, furniture, were, however, largely used until the theatre was considered good enough. The stage was elevated, and the auditorium, which was the only part of the building that remained, was a large part. The interior arrangements of modern American theatres are superior in comfort and convenience to those of Europe, although the latter are often lavishly decorated. In America, seating, heating, ventilation, exits and fireproof construction receive the most careful attention. The largest theatre in America is the New York Hippodrome, which seats over 5,000 and is used for spectacular entertainments. The modern theatre contains all its prototypes, and the auditorium and the stage. The auditorium is now the most elaborate part of the theatre. The opening on the auditorium is from 25 to 35 or 40 feet wide and from 14 to 22 feet high. The stage is frequently twice the height of the auditorium so that the scenery (there, etc.) may be hung above the proscenium opening when not in use. The set-scene is now in very general use and to a great extent eliminates.
the necessity for a high stage. The set-scene is built so solidly and reproduces the conditions of nature with such completeness as scarcely to make any demands on the imaginative faculty of the spectators. If a room is required, a high wall with marble solidity, a chandelier hangs from the centre of the ceiling; the doors shut with an unmistakable bang; the windows open and close better than they sometimes do in actual life. In elaborate plays while pieces of scenery are raised through large transverse openings in the stage by means of platforms called bridges. These work in and out of the well or cellar, a space under the stage nearly as deep as the proscenium opening is high. Above the stages are the flies, larger lateral galleries, in which the scene-men ("fly-men") work their ropes and pulleys. Higher still is the Grid-iron, an open line of strong beams from which various borders or drops are hung. Above this is the barrelof or rigging-loft, in which are the drums, pulleys or windlasses by which the curtains and clothes are worked. With the extensive use of elaborate scenes there was a demand for rapid shifting thereon, and this led to the revolving stage, which is a circular platform about 30 feet in diameter and revolving on a shaft embedded in concrete. This circular platform is capable of holding about four sets which can be brought before the audience by revolving the platform. The sliding stage is one of double width and which is moved laterally so that on the concealed half the following scene may be set up while the play proceeds on the exposed half.

Perhaps the greatest change in the modern theatre is in the lighting arrangement due to the introduction of electricity. The lights in the troughs below are called footlights, those above border lights. There are sets of bulbs in white and in two or more colors. Dimmers are used to lower the intensity of the bulbs. All lights (except perhaps the spotlights) are now controlled from a single switchboard at the side of the stage. Recently several open-air theatres have opened in America. Some of these are of the ancient type, as that at Berkeley, Cal., while others are of the so-called garden type in which the landscape architect plays a leading rôle. There is a good example of the garden type at Vassar College. Among recent innovations in theatrical structure are the little theatres, some of which seat only 100 and the portmanteau theatre, an approach to the medieval traveling theatre, but more artistic and better adapted to the present-day intimate form of drama.


THEATRE, The American. In order to convey to the reader a fair understanding of the progress of the American theatre since 1795 it is necessary to state something about its beginnings, which, indeed, previous to 1793, are involved in much obscurity. Toney Astor, an English stroller of some celebrity, in the Southern and Middle colonies about 1730, and gave entertainments at New York and perhaps other places, and there is some evidence that a company of comedians acted plays in New York in 1732; but it was not until 1749 that an organization came into existence of which we can form any definite judgment. This company attempted to open a playhouse in Philadelphia, and Addison's 'Cato' was actually performed; but the performers were dismissed by Recorder Allen to give up the undertaking. Thomas Kean was the principal actor in both tragedy and comedy, and one Murray seems to have been associated with him in the management. Finding Philadelphia too inhos- pitable, the players went to New York, where they were advertised as the company of comedians from Philadelphia, and gave the first theatrical season of which we have any connected account. The performances were given in a convenient room in a house belonging to Rev. Van Dam in Nassau street, and extended over a period of more than a year—from 5 March 1730 to 8 July 1731. The first play was 'Richard III,' in which Kean played Richard. So far as is known, the company appeared in 5 plays and nine farces. Although Mr. Kean formally announced his withdrawal from the stage to resume his business of writing, he was with a company called the "Virginia Comedians" at Annapolis in the summer of 1732, when Lewis Hallam and his London players arrived at Williamsburg, Va. Besides Mr. Kean there were other members of the New York company among these "Virginia Comedians." Perhaps this disposes of the claim usually made for Hallam's company as being the first regular theatrical organization in America.

Lewis Hallam, who brought a company of comedians from London in 1752, was not an actor of any consequence in England, nor is it likely that his wife, known to the American stage successively as Mrs. Hallam, and Mrs. Douglass, was an actress of recognized ability there.

The Hallam company reached Yorktown in June 1752, and began playing at Williamsburg on 5 September following, the opening piece being 'The Merchant of Venice' and 'Le Cid.' The only other play the Hallam company is known to have performed at Williamsburg was 'Othello,' 9 Nov. 1752. From Williamsburg Hallam went to New York, where he arrived in June 1753, and played until the fall. Mrs. Hallam played the leading parts in both tragedy and comedy, while her daughter, Miss Hallam, was put forward in farces. Hallam seldom appeared. The great Shakespeare roles were divided between Malone and Rigby, the
laying Shylock and Lear, and the latter and Romeo. From New York the com-
tit to Philadelphia, where the engage-
s was limited to 25 performances. This t he theatre was leased to Shakespear Hall-
r, who retired with his family to where he died soon afterward.
or two after Mr. Hallam's death his arried David Douglass, who organized cal company in Jamaica in 1758 for American campaign, with Mrs. Douglass hief attraction. Besides his mother, was the only member of class company who had previously ap-
the New York and Philadelphia the-
el had already become a full-fledged rd, although he was only in his 20th year, learing parts in tragedy and comedy: Harman, as Rigby he had previously em with Malone. Mrs. Harman, who laugher of Charlotte Charclo, and a ghter of Colley Cibber, was also with any, and next in consequence to Mrs.
The low comedian was Owen Mor-
as identified with the American forays. In 1760 he was at the John street house (1760-1769). arrival in New York, Douglass had hiency in obtaining permission to open re that he had built on what was uger's Wharf, and it was not until 28 g the following spring and summer glass built a theatre at Vernon and reets in Philadelphia, which he opened 1759, and maintained with considerable r until the close of the year. He had h authority to act from Governor Denny, ompact was kept, although the opposi-
teatre was so great in the province ct prohibiting plays was passed by the to go into effect 1 Jan. 1760. After phia was closed against him, Mr. Dou-
t to Annapolis, where he played an nt. The company also performed in rialand towns, and at Newport and co in 1761. In the autumn he built an-
another theatre in New York, in what Chapel (now Beechman) street, where performances from 19 Nov. 1761 to 26 52. This ended his first attempt to he mastery of the colonial stage. In years of management Douglass had in of considerable authority, at-
such parts as Sir John Falstaff in enry IV and Mercutio in Romeo and In the latter young Hallam played the his mother's Juliet. In the last New agement, Mrs. Hallam, the wife of the tragedian, was seen in a few parts, pair separated soon afterward.
ially been understood that after his it from New York in 1762, Mr. Doug-
ot venture upon the continent again 6, when he built the Southwark The-
adelphia. On the contrary, he ap-
 Charlestone in November 1765 and there until the following April. Lewis was now the very image of the 1 of Mrs. Douglass and Miss Hallam, rners were all new to the stage. Only the new players were still with Doug-
reach Philadelphia—Messrs. nd Wall and Miss Wainwright. With the opening of the new theatre in Southwark, Philadelphia, began the theatrical organization afterward known as the "Old American Com-
pay." Lewis Hallam was once more in the lead. Mr. Morris and Mrs. Harman were again with the company. During this season a so-called comic opera, 'The Disappointment,' said to have been written by Col. Thomas Forrest, afterward a distinguished officer in the Revolu-
tionary army, was announced for performance, but it was withdrawn because it contained "local reflections." As a recompense for its with-
drawal, 'The Prince of Parthia,' by Thomas Godfrey, Jr., was produced 24 April 1767. This was the first tragedy written and played in America. The season was noteworthy for the first appearance in America of John Henry, who was the partner of Lewis Hallam after the Revolution in the management of the Old American Company.
While the company was playing in Philadelphia, Mr. Douglass built a new theatre in John street, New York, which was the second of the permanent theatres in the colonies, the South-
wark being the first. The first season at the new theatre lasted from 7 Dec. 1762 to 2 July 1763. The company alternated between these two theatres down to the time of the Revolution; but Mr. Douglass found the patron-
age of the two cities inadequate as early as 1770-71. In the latter year he made a tour to the southward as far as Williamsburg, Va., playing at Fredericksburg, Suffolk and other towns, and building a theatre at Annapolis, where the company played an engagement in the autumn of 1771. In 1773 Douglass also built a theatre at Charleston, S. C., which was the last of the many buildings he erected for theatrical purposes. The company played at Charleston from 22 Dec. 1773 to 19 May 1774. In October following the Continental Congress passed a resolution forbidding theatrical per-
formances, in view of the impending Revolu-
tion, and the organization was disbanded. Hallam went to England, where he appealed to the London public at Covent Garden Theatre as Hamlet. His most famous role was his death in Philadelphia at the close of 1774, and Mr. Douglass returned to Jamaica, where he became a magistrate.
It is an interesting fact, showing the theatric-
al activity before the Revolution, that while the American Company was acting in New York and Philadelphia in 1766-69 there was a com-
pny in the South giving performances at An-
apolis and Williamsburg. This company was known as the "Virginia Comedians" in 1768, when it gave a long season at the Virginia capital; but it assumed the name of the "New American Company" when it was at Annapolis from January to June 1769. The leading spirits of the Virginia Comedians were Messrs. Ver-
lings and Bromadge, and Mrs. Osborne, who had played with Douglass at Charleston in 1765-66, and Mr. Godwin, who was with the American Company at the Southwark in Phila-
delphia in 1766-67. All these were with the New American Company, with the exception of Mr. Bromadge. A number of bills of the Vir-
ginia Comedians at Williamsburg in 1768 have been preserved.
The most important annals relating to the American stage that have escaped the destroy-
ing hand of time are a collection of playbills
made by Thomas Llewellyn Lechmere Wall—Mr. Wall of Douglass' company. These cover 40 years of the theatrical life of the actor and are especially valuable for the complete information they afford in regard to the Baltimore Company, organized by Wall and Lindsay in 1782. Wall was perhaps the only member of the American Company who remained behind when Douglass returned to Jamaica in 1774. He was also the only manager who undertook to conduct the theatre before the close of the Revolution. In 1781 he was at Annapolis giving entertainments with the assistance of his wife and daughter when the French army was on the march to Yorktown. For one of his performances at that time he succeeded in securing the services of the band belonging to the regiment of Count de Chautelet. Later in the year he went to Baltimore, where he repeated his Annapolis entertainments, and in conjunction with Adam Lindsay, a tavern-keeper at Fell's Point, built a theatre, of which Lindsay and Wall were the nominal managers, with Wall as the stage director. The company was formed on what was afterward known as the "commonwealth plan." The theatre was opened 15 Jan. 1782, and continued without interruption until 9 July—42 nights. In all 19 plays and 14 farces were produced, and the total receipts for the season were $14,209, an average of $338.50 per night. With the exception of the Walls the players were all new to the American stage, and, it may be assumed, were all amateurs.

The second season at the Baltimore theatre extended to 7 Feb. 1783. On the third night of the season at Baltimore, Mr. and Mrs. Dennis Ryan appeared in "Douglas." Ryan dominated the company from the outset, and when Wall retired from the management, 7 Feb. 1783, he assumed the reins, keeping the theatre open from 11 February to 9 June. From Baltimore Ryan carried his company to New York and opened the theatre in John Street. Wall was with Ryan's company, which remained until the British evacuation, giving two performances in October 1783, while the military players gave a performance for Mr. Ryan's benefit. In the winter of 1782-3, William Dunlap opened the Baltimore theatre, the season extending from 7 Dec. 1783 to 14 Feb. 1784. The only noteworthy event of this season was the first production of the "School for Scandal" in America, 3 Feb. 1783, with Mrs. Ryan as Lady Teazle. After the close of the Baltimore season in 1784, Dunlap took the company to Richmond, where he played a long engagement. Mr. Heard, who was the original Sir Peter Teazle in this country, joined the forces of Hallam and Henry; the other members of the organization found professional employment in the South during the rest of the century.

After the Revolution both Lewis Hallam and John Henry were almost continuously in control of the theatres that had been built by Douglass; but Hallam was the first to present a company of comedians to the New York public, opening the John Street Theatre 24 Aug. 1785. Hallam proposed a partnership with Henry, and the firm of Hallam and Henry ran the theatre that fall, but at the end of the season the theatre was placed in the hands of a manager, and during the next seven years, came into existence. The John Street Theatre reopened under their management 21 Nov. 1785. Henry engaged in England a number of capable actors and actresses whose names are part of the history of the American stage, while Wignell not only succeeded in building in Philadelphia the first really handsome and complete theatre in the United States, but put into it the best company of actors and actresses as yet been tempted to cross the Atlantic.

An incident of the Hallam and Henry partnership, previous to the reorganization of the company, that needed to be noted here is the production of the first American comedy, "The Contrast," by Royall Porter. This play was first produced in New York 18 April 1787, was written for Wignell, who wished to play a Yankee character. Wignell's Jonathan deserves remembrance as the forerunner of the long series of stage Yankees that afterward became popular with American audiences. The comedy was printed in Philadelphia, and was often played by strolling companies before the close of the century.

The only really important recruits engaged by Mr. Henry in England were Mr. and Mrs. Hodgkinson of the Bath and Bristol theatres, and Mrs. Wrighten, who had long been a favorite singer and actress at Drury Lane. Hodgkinson was a man of great talent and versatility, and the best actor seen in America up to that time and for many years afterward. He made his début as Don Felix in 'The Wonder,' at Philadelphia, 26 Sept. 1792, succeeded Henry as one of the managers of the Old American Company in 1794, and was active as actor and manager in New York until after the opening season at the New Theatre in 1798. Mrs. Hodgkinson, known at Bath and Bristol as Miss Brett, was an actress of merit, and in this country eclipsed both Mr. Henry and Mrs. Hallam, the wives of the managers by whom the Hodgkinsons were engaged. Mrs. Wrighten was known in America as Mrs. Pownall. She died at Charleston in 1796, after introducing her two daughters to the stage in this country. One of them, Caroline, married Alexander Placide, who had been a rope dancer in England. She was the mother of the famous Placide family of actors. It was during this period that William Dunlap became prominent as a dramatist and adapter of plays. His first comedy, 'The Father,' was produced at the old John Street Theatre, 7 Sept. 1789. Dunlap became associated with Hallam and Hodgkinson in the management of the New York company in 1790, and he was afterward for a brief period the sole manager of the New Theatre, better known as the Park.

After leaving the Old American Company in the beginning of 1792, Thomas Wignell associated himself with A. Reinagle, a musician who came to America in 1786, in the project of building the New Theatre in Philadelphia, afterward known as the Chestnut Street Theatre. The theatre was modeled after the theatre at Bath, and was ready for use when, owing to the yellow-fever epidemic it was not opened by the company of players engaged by Wignell until 17 Feb. 1794. Among the actors and actresses comprising the Philadelphia company were Mr. Fennelly, the young tragedian of much promise, Mrs. Wignells, a daughter of Mr. Wignell, Mrs. W. Keys, and Mrs. W. Talfman. Miss George, who was the wife of the lawyer James Oldmixon, was known to our stage as Mrs. Oldmixon. This company remained intact without any im-
changes or additions for three years, alternately in Philadelphia and Balti-
mie in the autumn of 1796 Mr. Wigg-
spent three important recruits from Eng-
Mr. Merry, the famous Miss Brunton
theatre, who had become the
Robert Merry, the Della Cruscan poet;
Althorpe Cooper, then a young man of
stined to be the manager of the New
ere for many years; and William
who had been a struggling actor, and
began the successor of
in the management of the Philadelphia
Mrs. Merry became a widow in 1798.
and death she became the wife of Warren,
ived her many years.
tnight before the formal opening of the
theatre by Wignell's company a
in Boston, scarcely inferior to the
theatre house, was opened by an English
engaged and brought over by Charles
This theatre was in Federal street
built by subscription. It was destroyed
1798. Powell's company was a feebly
he closed his second season in 1795.
was John Barret, the son of Royall Tyler, the author of 'The
who managed the house on behalf of
of Sharee Brown, and an English actor, whose wife was
in London as Miss Fontenelle; but
or his wife nor a stronger com-
and had as yet been seen in Boston
to make the season successful. One
this was that a new theatre, known
Haymarket, had been built through the
of Charles Powell, and opened by
the first time 26 Dec. 1796. Among
English recruits for the Boston Hay-
were Mr. and Mrs. Giles L. Barret, a
of the famous New York comedian,
H. Barrett; Mr. and Mrs. Simpson,
d New York favorites; and Mrs.
's three daughters, the Misses Wes-
were Mrs. William
1; Eliza, successively, Mrs. Villiers and
aids; and Ellen, Mrs. Darley. Powell
ated at the Haymarket, and the house
the control of Hodgkinson, Hallam
nap, under the personal direction of
The New York company occupied
summer of 1797, after which it was
ed. The Haymarket deserves to be re-
d for the production of two American
ys — 'Bunker Hill' by John Daly
Feb. 1797; and 'West Point Pre-
the first of the André pieces, by Wil-
on, on 17 April following. Dunlap's
was not produced in New York until
1 79 8. This epoch, 1792-98, was also
the theatre activity in the South.
had the Baltimore company, including
Mrs. Ryan and Mr. Wall, played a
agement at Richmond as early as 1784.
90 John Bigmall and Thomas Ward
re the managers of a company called
'Continental'. The organization con-
ed its existence for many years, its
xtending from Richmond and Norfolk
eston. Bignall, who was held by his
admirers to be the best actor on the
continent, died in 1794. His real name
Moneypenny, and he had been a stroller in
England in the same company with William
Warren, of the Philadelphia theatre. After
Bignall's death West became the sole manager
of the company and piloted it over the South-
ern circuit for a number of years. In 1795
there was a rival theatre in Charleston, con-
ducted by Mr. Jones, who had been previously
at the Boston Theatre. His principal actress
was Mrs. Whitlock, who had made her debut
in the Philadelphia company. A Frenchman, M.
Sollee, succeeded to the management of this
theatre, and organized a company in Boston to
play in Charleston for the season of 1795-96.
Mr. and Mrs. Whitlock, Mr. and Mrs. Placide
and Mrs. Arnold — afterward Mrs. Poe and
the mother of Edgar Allan Poe — were in the
company.

The prosperity which had given to America
three splendid theatres within five years — the
Chestnut Street in Philadelphia, the Park in
New York, and the Boston Theatre in Federal
street, Boston, rebuilt immediately after its
destruction in 1798 — was followed by a period
of depression that was severely felt over all the
country. At the close of the season Wignell
was in jail for debts incurred through the
Philadelphia theatre, and Dunlap, who had
undertaken the sole management of the New
York theatre to retrieve previous losses in New
York and New England, lost his entire private
fortune in the venture. Mr. Barrett was in-
duced to undertake the management of the
new Boston Theatre in 1799, but he failed dis-
mally.

In all these cities theatrical enterprises were
experimental for several years, but in every
case a manager was finally found in the local
company who succeeded in placing the theatre
on a sound business and artistic basis. Mr.
Warren, after he became Wignell's successor in
Philadelphia, associated with himself in the
direction of the Chestnut Street Theatre a
popular young member of the company, William
Burke Wood. This partnership lasted until
1825. In New York the young tragedian Cooper
retrieved the fortunes of the Park Theatre, and
made the house a paying one for a period of
years. In Boston, Snelling Powell, a brother of
Charles Powell, secured control after other
ttempts had failed, including the assumption of
the management of the Boston Theatre by
Charles Whitlock in 1800. John Bernard, an
English actor of some repute who joined the
Philadelphia company in 1797, was for a while
Snelling Powell's associate in directing the
Federal Street Theatre; but for many years
Powell's partner was Mr. Dickinson, who
was an actor of moderate ability, but a man of
sound judgment and an excellent manager.
These were the dominating theatres in the
United States during the first quarter of the
century, and their influence in giving tone and
character to theatrical enterprises in the country
was felt down to 1850.

The Old American Company was designed
to be permanent in organization, but all the
early managers, from Douglass to Wignell and
Hodgkinson, aimed at controlling the
playhouses modeled after the provincial circuits
in England. The building of the new theatres
in Philadelphia, New York and Boston resulted in
giving companies that were permanent in
organization permanence of home. These were the real stock-company days, but a tendency toward the star system was manifested almost from the outset. In 1796 Mrs. Whitlock played what was essentially a star engagement at the Boston Theatre; it was limited to 12 nights, for which she was paid $450 and allowed a benefit. Hodgkinson played star engagements in all the leading cities between 1798 and 1805, and Cooper followed Hodgkinson's example, and was a star from youth to old age. But the first star of all the many, or of the few in the American theatrical firmament was George Frederick Cooke. He was the first English actor of great reputation who came to America to play the leading roles of tragedy and comedy with the stock companies in the principal cities. In view of this the star system, as it ruled in the American theatres for the next half century, may be said to date from his appearance here in 1810-11.

Simultaneously with Cooke's performances in Philadelphia, New York and Boston were the star engagements of John Howard Payne. Cooke played three engagements in Philadelphia—in all 39 nights. His highest receipts for any one night were $1,473, but his average for the last Philadelphia engagement of 12 nights in 1811 was $807.50. Payne played to an average about the same time of $442, while Cooper's Philadelphia average was $539. Young Payne's popularity rapidly diminished, and in 1812 he performed to receipts that fell as low as $235. After Cooke the next English star to appear in America was Holman, in 1812; but he came at a time of serious depression in consequence of the war with Great Britain, and the impression that he made fell far below his expectations. Then came Inceleton and Phillips as musical stars, and after them the Wallacks, Henry and James W., and finally, to close the first decade of the star system in America, 1810-20, Edmund Kean. The great English stars who came to this country during the next three decades were Junius Brutus Booth and William Charles Macready, 1820-30; Fanny Kemble and her father, Charles Kemble, and Charles Kean, 1830-40; and Tyrone Power, James R. Anderson and Macready, again in the fullness of his fame, 1840-50. This long period had developed only two American stars of surpassing brilliance—Edwin Forrest and Charlotte Cushman.

The century opened with about half a score of theatres in the leading American cities, only three of which, as already described, were worthy of the name or of the drama. Between 1800 and 1850 about 20 theatres were built in New York, none of them superior to the Park, and only one, the Bowery, in any sense its rival, until the Alhambra opened in Chamber-street in the last decade of the epoch. The only new theatres of importance in Philadelphia during the period were the Walnut Street and the Arch Street theatres, the former erected to a contract of $90,000, by Edward Lathrop, and the latter built in 1826. The theatres built in Boston in these 50 years were the Tremont, the American Amphitheatre, opened the Warren and National Kimball's Museum, the Lincoln and the Harvard Athenaeum. Baltimore had nothing better than the old Holliday Street Theatre during this epoch.

Washington was without a place of amusement worthy of the drama until 1835. The builder of the period in the South and west was James H. Caldwell. He built the American Theatre in New Orleans in 1821, afterward erected the Camp Street and Ph Street theatres. Mr. Caldwell also built in Cincinnati, Saint Louis, Natchez, New Orleans and Petersburg. Another John S. Potter, was concerned in the many, or of the few in the American theatrical firmament was George Frederick Cooke. He was the first English actor of great reputation who came to America to play the leading roles of tragedy and comedy with the stock companies in the principal cities. In view of this the star system, as it ruled in the American theatres for the next half century, may be said to date from his appearance here in 1810-11.

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delphia, by James H. Wallack in New York, and later Moses Kimball in Boston, stock companies were maintained. Later on, Lester Wallack, Augustin Daly, M. H. Mallory, Daniel Frohman, Charles Frohman and A. M. Palmer in New York, and R. M. Field in Boston, kept together for years organizations which were more nearly the permanent system. Throughout the country generally the theatres for a while employed stock companies, but mainly for the purpose of supporting traveling stars. This continued until after the close of the Civil War, when the impetus given to business enterprises of all kinds was felt in renewed theatrical activity not only in the cities, but all over the country. What is known as the combination system (that is, a traveling company made up of a star and a supporting company), which began about 1869 and reached its highest development before 1876, involving the destruction of the stock companies in all except a few theatres, was the consequence of this theatrical revival. Nearly every inland town and city from Maine to California built a theatre, with the expectation that traveling companies would occupy it at intervals. The demand thus created could be supplied only by the combination system.

One of the first results of this new state of things was the banishment from the managerial office of all, or nearly all, the actor-managers. Their places were filled by business men, who, while they may have lowered, in a sense, the artistic character of the theatre, have raised its financial standing to a point which, during the first century of its existence, seemed beyond its reach. The theatre in America was no longer a haphazard thing, living from day to day on uncertainty. It became a business conducted on the principles which govern other forms of commercial enterprise, and is as stable, as sound and as certain of adequate rewards as any. Indeed, so abnormal has been the development of the business character of the theatre that it has excluded from general managerial attentiments everything else. Very few of the managers throughout the country ever undertake the original production of plays, or take the trouble to acquire the artistic knowledge requisite to their business. Chicago and Boston, are the play-producing centres. A few New York managers and the play-producing stars select and bring forth all the plays and gather together all the companies which, supplemented by the imported attractions, keep the theatres of the country supplied with entertainment during the season. The advantage of this system is that playgoers everywhere are furnished with well-trained and perfectly equipped companies, appearing in plays which have been tried and found to be worthy. The local manager, free from the worries and cares incident to stage-work, devotes his time and attention to the patronage of the patrons at the front of the house, and to the strict conduct of business there. The results are well-regulated and comfortable auditoriums and good order in all the business departments of the theatre.

A remarkable aspect of the American theatre, from a commercial point of view, is the enormous profit it has yielded and continues to yield to home and foreign celebrities. Among American actors, Edwin Forrest acquired and left behind him a great estate, from the remnant of which was established the Forrest Home, near Philadelphia, a retreat for aged actors, noble in its purpose and efficient in its benefaction; Charlotte Cushman, resting for long periods in England and Italy, left a fortune of $600,000; Edna Booth, having made and lost more than one romantic romance of financial successes in his declining years, and left $750,000 to his heirs, after having founded the Players' Club at a cost of $200,000; Mary Anderson retired from the stage after a few seasons of brilliant and uninterrupted triumph, to enjoy a happy marriage in her youth, her labors having brought her a fortune of $500,000; Joseph Jefferson, blessed with that continuous vitality often found among the children of the stage, had in 1902 acquired a fortune of $1,000,000. Among foreign actors, William C. Macready owed to America the realization of his dream of retirement from a profession he affected to loathe; Sarah Bernhardt acquired here a fortune which enabled her to defy the authority of the house of Molière and to establish a theatre of her own in beautiful Paris; Tommaso Salvini, adding his great earnings here to his modest ones in other lands, became the richest actor Italy has ever known; and Henry Irving has found in his frequent visits to our country a public eager and willing to fill his coffers to overflowing with the rewards so justly due to his unequalled managerial achievements and to his undoubted genius as an actor. In the moving picture field Charlie Chaplin passed everybody else, and his income is stated to be fully $1,000,000 annually. The list of the well-rewarded favorites of the public might be greatly extended, but this glimpse of results is sufficient to make clear the profits and prosperity of the American stage, and to indicate the extent of its commercial advancement during the century.

The development of the theatre in all its departments, especially since 1860, has been vast. From not more than 100 in 1800, and fewer than 800 in 1860, the number of actors and actresses in the United States increased so immensely that in 1888 it was estimated at 4,500, and now probably exceeds 10,000. This number represents only New York, Chicago and Boston; it does not include the managers, who number several hundred, as compared with 25 or 30 in 1850 and six or eight in 1800. If the exponents of variety and vaudeville and the other employees in the amusement business are included, the number of people who gain a livelihood by giving public entertainments will not fall below 30,000; including stage hands and all the persons who derive their support from the theatre, the number may be roughly estimated at 100,000. This vast army of workers is well organized, generally well paid and reasonably prosperous. It has numerous charitable and social organizations, which are models of their kind. The Actors' Fund, the Actors' Order of Friendship, the Players' Club, the Green Room Club, the Lambs' Club, the Professional Women's League, are institutions of which any profession might well be proud; and there are numberless others of equal merit supported by the amusement makers of the United States. There are about 1,000 regularly organized theatrical companies on tour through the United States during the
season, and the number of theatres of all kinds is 10,000.

In New York City there were in 1918, the following theatres: in Manhattan borough, about 50 theatres worthy of the name, the largest being the Hippodrome (seating 5,000), followed by Metropolitan Opera House (3,500), Metropolitan Opera House (3,566) and Century (2,800); and about 50 vaudeville and motion picture houses of the best class, the larger ones being the Old Academy of Music (3,400), Strand (3,300), Audubon (2,653) and Lexington (2,559). In Brooklyn borough there are about a score of good theatres and some 80 first-class vaudeville and motion picture houses, the largest being the Halsey, Keeneey, Ridgewood and Prospect, each of them seating 2,500. There are perhaps a thousand other minor theatres and picture houses.

The improvement which has taken place in the construction of theatres in America within the last 35 years is worthy of especial notice. The tragic disaster in Brooklyn on the night of 6 Dec. 1876 awakened the attention of managers and of the public authorities in the different States to the flimsiness of construction which marked even the best theatres of the period. The result was the passage of new and most stringent laws, involving requirements which, while they seemed onerous, perhaps, have resulted in giving to America the best and safest theatres in the world. Even the older theatres, built before the new regulations, have been so altered under the direction of the authorities that they are now comparatively free from danger. In New York, where these regulations are perhaps the strictest, there is a larger number of absolutely safe theatres than in any city in the world; while for beauty and convenience combined with safety it is impossible to find elsewhere such theatres as the Century, Strand, Gaiety, New Amsterdam, Victoria, New York Knickerbocker Empire, and Metropolitan Opera House. The older houses pass away as they are replaced by absolutely fireproof structures if replaced at all.

Perhaps the most marked change that has taken place in the American theatre during the last half century is in the character and number of its patrons. Attendance upon the theatre was looked upon even 60 years ago by at least seven-tenths of the people of the United States as almost a sin. The fashionable ungodly and the lowest and most depraved made up the audiences. We have seen how, in the Revolutionary period, theatres were closed by act of Congress, doubtless because, in those days of danger, the fathers of our country felt that they would help their cause by propitiating the Almighty, who was supposed to frown upon godless amusements. But in the last three or four decades this unreasonable prejudice against the most enjoyable and least harmful of amusements seems to have so materially lessened that it is estimated by a good authority that not more than one-tenth of the people refuse to patronize the theatres as a matter of principle. It is true that a clergyman now and then takes hold of the stage in the old-fashioned, puritanical way; but his words, in all likelihood, fall upon ears that the night before were listening to the sermons of 'Camille' or were taking in the laughter-provoking eveth lines of 'The Private Secretary.' Indeed, element of moral usefulness in the theatre no longer successfully divided.

The phenomenal development of the modern picture theatre has made many changes in stage since the dawn of the 20th century. Theatre managers who clung to the remodeled productions of the old school in business, and there were years of dark and numerous failures. Some tried to look back the crowds by going in the limit on plays exhibiting crime, and for a few years there was scant decency in many American playhouses. When this failed, the more sensible managers accepted the moving picture as an adjunct, and many utilized it as a vaudeville feature. The war also had a disintegrating influence; many of the younger actors went uniform and were lost to the profession. Plays were called for, and a few strong productions resulted. The number of new pictures produced in America is small, however, as only 100 are staged annually in New York City, perhaps a dozen in other cities. Those that run more than 100 nights are voted to be successes. The remainder of the performers in New York are either reproductions of European authors, or old plays, of which it is possible to catalogue the best plays that have been, and go, though many of them will be fo by reference to Drama. See also MOV PICTURES.

**Names of Some Famous Actors**

Professional  Real
Abingdon, Wm. L.  Pilgrim, Wm. Hopper
Abbott, Benie  Brown, T. W.
Adams, Maude  Kiskakken, Maude
Alma, Mme  Gye, Mrs. Ernest
Alida, Frances  Gatti-Casanza, Mrs. G.
Alexander, Sir George  Sampson, Sir George
Allen, Villa  Dunves, Mrs. Peter
Anderson, Mary  Landy, Mrs. A. P. de
Anglin, Margaret  Hall, Mrs. Howard
Arlin, George  Arliss-Arondge, Mr.
Arthur, Julia  Cheney, Mrs. Ben; P.
Ashley, Minnie  Chamber, Mrs. Wm. A.
Baird, Dorothée  Osborn, Mrs. Harry B.
Barrymore, John  Osborn, Mrs. Harry B.
Barrymore, John  Osborn, Mrs. Harry B.
Baume, Kate  Cowie, Mrs. George
Bates, Blanche  Cret, Mrs. George
Bentley, Irene  Seely, Mrs. Harry G.
Bernard, Sam  Barnett, Sam
Beaver, Sarah  Barnes, Sarah
Blair, Eugene  Downin, Mrs. Eugene
Blair, William  Downin, Mrs. Eugene
Bobb, Lillian Evans  Pendleton, Mrs. W. P.
Borth, Rachel  Powrie, Mrs. Jas. T.
Buffalo Bill  Cody, William P.
Burt, Base  Zaneff, Mrs. Florence
Burt, Laura  Johnson, Mrs. J. A.
Butler, Jesse  Joy, Mrs. F. C.
Cahill, Marie  Arthur, Mrs. Daniel W.
Calvé, Emma  Gaspari, Mrs. Alice
Cameron, Beatrix  Mansfield, Mrs. Richard
Cameron, W. A.  De Benaic, Mrs. Richard
Campbell, Mrs. Patrick  West, Mrs. C. Conwell
Carr, Richard  Chase, N.
Carter, Mrs. Louise  Payner, Mrs. W. L.
Carus, Emma  D'Urville, Mrs. Harry J.
Castle, Vernon  Fitcher, Mrs. Vernon
Cavaliere, Lina  Munro, Mrs. L.
Chase, Pauline  Alts, Mrs. Anna
Claire, Ina  Fagan, Miss.
Clayton, Kate  Stevenson, Mrs. Cass A.
Clayton, Marie  A. W. A.
Coggan, Gertrude  Sullivan, Mrs. John
Coggan, R.  Sullivan, Mrs. John
Conquest, Ida  Averett, Mrs. John
Corinne  Phlatonis, Mrs. C. E.
Crawford, Miss  Klauber, Mrs. Adele
Cronan, Henrietta  Campion, Miss
Dale, Alan  Cohen, Alfred J.
D'Avril, Camille  Cromwell, Mrs. John
Davies, Frank  Cunningham, Mrs. James
Dawe, Millie  Fellers, Mrs. John

**Mov Pictures**
### S of Some Famous Actors — Continued

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**THEATRE, STAGE MECHANICS OF.**

A stage mechanism is that visible part of a platform advanced at the rear of an auditorium which is concealed when not used and can be pulled up within it or opened out of reach. The stage and all that may be arranged upon it should be conservative of the lines of sight and bearing of the spectator and auditor.

From earliest times such an elevation or platform, or a depression or pit, had been usual for representation or entertainment before spectators. The earliest choruses were in the circle or pit evolved into the Greek classic theatre, with its scena or house or scene or stories, which filled the background of the stage, the action being within the semi-circular arch or pit in front.

The mechanism of the ancient theatre was very exact in every respect. The religious character of the performance established fixed and usually religious meanings for everything done or said in the play. The scenery was probably limited to painted curtains at the back and revolving triangular prisms at entrances. Machinery for startling effects was, however, usual. The Roman invasion resulted in the extension of the stage more and more forward, until it became a platform sufficiently large to hold the chorus and entire group of performers.

The ancient Greeks bore the same relation in art and theatricals to the world of their time as the modern French do to-day; consequently even the traveling companies of the various nations followed crudely the methods of performances usual with the Greeks, and, indeed, the general conduct and character of the modern theatre is in many respects followed the original classic traditions: The entrances and exits on the modern stage, much of the symbolic values of parts of the stage and the arrangement of scene movement are directly inherited from the old Greek theatre: In later medieval times a portable stage or cart was used. But little advance can be noted in stage mechanism until after the time of Shakespeare and of Molière, when modern inventions began to appear. Richard Wagner and the Germans revolutionized stage settings and theatrical architecture, as notable in Wagner's Theatre in Bayreuth and the Burg Theatre in Vienna. The German's leadership in applying science to and otherwise improving stage mechanisms has been followed by every European nation, notably in England, by Sir Henry Irving, whose system of lighting is especially remarkable in the conveyance of the feeling of atmosphere to the senses of the spectator. In America Steele MacKaye was progressive in improving the mechanism of the stage. Later, the proprietors of the New York Hippodrome developed most elaborate and complicated mechanisms for spectacular productions.

While the use of gas and movement of scenery in grooves had been universal during the past century until 1875, yet in many theatres today such modes of lighting and scene shifting are still retained. In the theatres of to-day, where electricity and the most modern machinery are employed, the following are the terms and uses of the stage machinery:

**THE STAGE.**

**Rake, Thr.**—The rake is one of the stage floors, from the front frame, used to raise or lower the floor. It is generally placed with a slight downward slope toward the audience. The rake of the stage is the portion of the stage which is raised or lowered to the depth of each piece of the scenic framework or of the curtains. **Pres. thr.**—The architectural arch and spandrel which supports the curtain, as it were, a massive brace to the picture which the curtain reveals.
THEATRE, STAGE MECHANICS OF

It is assumed that there are four entrances. Those are counted 1, 2, 3, 4, from down stage up.

N. B.—Though there may be but one entrance on one side of the interior setting—direction may possibly be given to set a fireplace or window R. (right second); that is to say, where right second entrance should have been had it existed.

EXPLANATION OF THE ABBREVIATIONS.

| R. 1. E. | Right first entrance. |
| R. 2. E. | Right second entrance. |
| L. 1. E. | Left first entrance. |
| L. 2. E. | Left second entrance. |
| L. 3. E. | Left third entrance. |
| L. 4. E. | Left fourth entrance. |
| C. | Centre of stage. |
| D. | Down centre line. |
| U. | Up centre line. |
| R. | Right centre line. |
| C. | Centre line. |
| D. | Down right centre line. |
| U. | Up left centre line. |
| L. | Left centre line. |
| D. | Down left centre line. |
| U. | Up right stage. |
| L. | Left down stage. |
| R. | Right down stage. |

THE SCENEY.

WING, A.—A single piece of scenery, ordinarily 5 feet 4 inches wide by 18 feet high.

PLAT, A.—A double wing, either hinged or battened together.

BORDERS.—Stripes of canvas hung crosswise above the stage by means of a set of lines. These may either represent the sky, the branches of trees and foliage, etc.

CEILING.—A square of canvas set to light frame of wood which is lowered by means of a double set of lines—one set “up stage” (back of stage), the other “down” (front of stage), until it rests squarely upon the interior set.

BOX SET, A.—A complete interior setting.

DROP, A.—A large canvas representing the back-ground of the setting. In the case of a complete exterior setting, the drop extends the full width of the back of the stage; in the case of an interior setting, where, for example, only a window and a door present a view of the outside, the drop may be much narrower.

JOG, A.—A narrow drop, hung by a single line.

JOG, A.—A narrow piece of scenery, wherein two flats or wings of an interior setting may be joined, either for extension or to form a quadrangle.

RETURN PIECES.—Two wings affixed to an interior setting, which turn off stage, back of each side of the proscenium opening.

MACHINES.—Either a wing, or two wings hinged together, set back of some opening, window or door.

MASKING PIECES.—A piece of scenery, drop or wing, set behind an opening to conceal either the scenery or the bare stage immediately behind it.

BRACES.—Two narrow strips of wood, five feet long, either permitted to slip alongside each other or made fast to each other by means of a turn-screw once the desired extension is reached. The top end has a small iron grip attached, in the shape of a ram’s horns; the lower has a narrow short blade of steel intended to trail flat upon the ground and containing a hole sufficiently large to admit a screw-pin. The grip at the top of the brace is first introduced into a screw-eye attached to the back of a piece of scenery; then the desired length of the brace is secured by means of the centre screw, so that it reaches the ground obliquely; lastly, then, the screw-pin fastens the brace securely to the ground; and thus may scenery be held in position.

LASHLINES.—Pieces of light rope fastened at the side of the wooden frame near the top of a wing or flat, for the purpose of fastening this wing or flat to the next one.

THE LIGHTS.

FOOTLIGHTS (of the stage).—Rows of lights along the front edge of the stage.

BORDER LIGHTS.—The illumination of a series of electric bulbs in a long tin reflector, extending the entire width of the stage and hung up in the air, by means of a set of lines, back of the canvas borders. There are usually four border lights, more or less, according to the depth of the stage and the style of the play. No. 1 border light is hung close to the curtain down stage; No. 4 is hung well back of stage; the other two, Nos. 2 and 3, occupy the intersecting positions.

STRIPS.—Several electric bulbs set to a narrow strip of wood, varying in length according to necessity—usually
our feet long, which may be movable and hung anywhere back of the setting.

BUNCH LIGHT.—Several electric bulbs inside of circular and moveable trans-fuser.

CUSHION. An oval, sheet-iron box with an open front 18 inches by 14 inches, set upon a long steel rod encased in a ring, for the purpose of raising or lowering. The box is painted white within and contains carbon holders and carbon sticks—and is for the purpose of throwing a white hood of white or colored light.

MINIATURE.—A light frame of wood, the size of the opening in the back of which is covered with a thin sheet of gelatine; the gelatine being colored either red, blue, green, amber, etc. Thus sunset glow may be thrown, or light effects may be secured by the use of a different medium.

LENSES.—A sheet-iron hood, set to a steel rod and operated in the same way as the box calcium, but for the purpose of throwing a shaft of light: that is, a moonbeam, a sunbeam.

POCKETS.—Concealed, safety, steel pockets in the floor of the stage, on 18-inch rods, for the purpose of converting wires, leading to calculi, bunch lights, etc. Usually there are three pockets on each side of the stage.

THE SWITCH-BORD. —The electric board—usually on the prompt side—where all connections are made for the electricians to operate all the lights from a single place.


THÉÂTRE FRANÇAIS, tük-àr frán-sā. See Comédie Française.

THÉÂTRE LIBRE, lē-br. in France, a theatre for the populace, subsidized by the government and admission to which is practically free to all citizens of the republic.

THEATRICALS, Amateur. See Amateur Theatricals.

THEBAN CYCLE. A series of old Greek epic poems dealing with Theban legends. They include 'Thebaid,' which tells the story of the house of Labdacus and the attack of the Seven on Thebes; the 'Epigone,' which relates the capture of the city, and the 'Edipedia,' which tells the story of the hero Oedipus. The poems average about 60,000 lines each.

THEBES, thēbz (Egyptian Net, the No of the Bible; Greek Thebai or Dióspolis), Egypt. a famous ancient city, whose ruins are situated on a high mound, about eight miles south of Cairo, near the modern villages of Karnak and Luxor. The ruins are among the most magnificent in the world. The largest is the great temple of Ammon at Karnak on the east bank of the river. It was begun during the Twelfth Dynasty and enlarged by kings of the succeeding dynasties down to the time of the Ptolemies. It stands within a large enclosure which also contains several minor temples. An avenue of sphinxes leads to the main entrance, which is a huge pylon, 142 feet high. This leads into a court measuring 270 by 338 feet, and traversed by a double line of colossal columns. A second pylon leads into the great hall or hypostyle, whose roof was supported by 134 columns in 10 rows. The columns of the two courts are 28 feet high and 33 feet in circumference. All were brilliantly painted and sculptured, and many of the columns still retain their bright colors. Other pylons lead into the inner courts, one of which contains two obelisks 96 feet high. A colossal statue of Ozymandias is on one of the obelisks. The entire structure is 1,200 feet long and about 350 feet wide. At Luxor, also on the east bank of the river, and a short distance south of it, there are fine ruins of another temple of Ammon, built by Amenophis III and his successors. On the west bank the principal ruin is the Tombs of the Kings, hewn into the rocks of the hills; the Ramesseum, or Memnon, 64 feet in height; these is the celebrated 'vocal statue;' and other remains of tombs and scattered over the neighborhood on the river. After the expulsion of Thespis became the capital of Egypt remained so until the beginning of the 1st Dynasty. It declined in importance with the exception of a short period in the 7th century B.C., when it was again a capital. The Ptolemies repaired its gates and roads, and did the Romans. An earthquake worked havoc with its ancient ruins. Since then Thespis is nothing more than a collection of ruins inhabited by a few families of Felahin, who obtained a precarious livelihood by guiding summer visitors to the ruins or rifling the tombs for antiquities. See Davies, N. de G., 'Five Theban Temples' (in Archæological Survey of Egypt, 1888); Bulletin of the Metropolitan Museum of Art (New York 1916); Le Fargue, H., 'The Theban Temples;' Les Camisard, A., 'Ancient Thebes' (Berlin 1850-59); Mariette, A. E., 'Monuments of Upper Egypt' (London 1877); Naville, H., 'Deir El-Bahari' (London 1894-1906), also Egypt.

THEBES (Greek, Thebai), Greece, the principal city of Boeotia, was situated on an elevated plateau, south of Mount Phæa, now being occupied by the unimportant town of Thiva (pop. 3,500), at the juncture of the road leading north from Athens, the transversal road leading from the Stratheikon to the coast of the Gulf of Corinth to the west. It was one of the most celebrated cities of Greece, the birthplace of Pindar, Epaminondas, and Pelopidas. Cadmus, leading a Phoenician colony, is said to have founded the city by his son. It was near the site of the city of Cleon (1500 B.C.). The principal name in the history of Thebes is that of Oedipus, the recorded event in his history took place B.C., when Philolaus drew up a code for the Thebans. During the Persian War the Thebans rendered important services to the Spartans; but they afterward, through jealousy of the Spartan ascendancy against them in 382 B.C., though peace then prevailed. Phæbus, a Spartan commander, treacherously put himself at the head of the Cadmeia, which was held by the Spartans until Pelopidas and Epaminondas led a conspiracy which resulted in the tyrants' defeat (536 B.C.). Open war now raged between Sparta and Thebes, which in the humiliation of the former by the defeat of Leuctra (517). Thebes, brilliant leadership of Epaminondas was at this time at its height. Hence supremacy departed when the former the battle of Mantinea (362 B.C.), rise of the Macedonian power. Thebes...
THECLA — THEISM

n alliance with the Athenians and other s against Philip. After the battle of thea (338 B.C.) it was obliged to receive a
lonian garrison. On Philip's death an action broke out in Thessaly and an at-
was made to drive the Macedonians from thea. But Alexander hastened to their
captured and destroyed (336 B.C.) the
and reduced the inhabitants to slavery.
years afterward Cassander rebuilt
; but it never recovered its former im-
cence. In the 4th century the Romans against
ces, king of Pontus, it joined the latter:
gratitude to Athens, and was severely
ed by the Romans under Sulla. From
me the Thebans as a power in Greece ully disappear from history. In the 11th
th centuries it was again in a prosperous
ion as a result of the introduction of silk
cturing. It was sacked by the Normans.
 Consult Baedeker, Karl, 'Greece' (4th d., Leipzig 1909); Fabricius, E., 'Theben
burg 1890'); Müller, M., 'Geschichte The-
(Leipzig 1879); Stern, E. von, 'Ge-
de der spartanischen und thebaischen
onic' (Dorpat 1884).

THEISM, the doctrine of the existence of a God or Gods. It may take the form either of monotheism or polytheism and is opposed only
to atheism, which denies the existence of such
divine beings. From its use to express the
belief of cultured Christian peoples, the term
has been given a more restricted meaning.
Thus, theism has been identified with monothe-
ism, as implying belief in one God, and hence
is distinguished from all forms of polytheism.
Further, theism is distinguished from pantheism.
On the one hand and deism on the other.
Pantheism (q.v.) merges God with the world-
process and thus practically denies his personal-
ity. Deism (q.v.) emphasizes the personality
of God, but conceives him as existing apart
from the world of his creation. Theism
endeavors to rise above both of these extremes
and embrace the truth contained in each. On
the one hand it maintains the personality
of God and his transcendence of the world. On
the other it insists upon the immanence of God,
upon his presence in the world as the all
powerful and life-giving agency. Thus the God of the-
ism is at once the Author and the Preserver of
the world. In every age and among every
people of history some form of theism is to be
found as the basis of religious observance. This belief is refined and developed with the pro-
gress of thought and civilization and the direc-
tion of this development is generally in the line
above mentioned, from polytheism to mono-
theism, and on to a comprehensive theism.
Thus the traditional polytheism of Greece broke
down under the influence of philosophic re-
spection; but this reflection itself culminated in the
theistic philosophy of Aristotle. As the theo-
logical basis of religion and the ultimate explana-
tion of the universe, theism has always had a
prominent place in systematic reflection. In the
earlier centuries of the Christian era it was the
subject of supreme importance and the best effort
of theologians and philosophers was given to
its discussion and exposition. As a result, cer-
tain proofs for the existence of God were for-
mulated, the most important of which possess
considerable historic interest. We may men-
tion three of these arguments: (1) The Onto-
logical argument, first proposed by Anselm, in-
ers the existence of God from the idea of a
most Perfect Being. The presence of this idea
in the human mind entails the existence of such
a Being, for existence is one of the perfections
necessarily contained in the idea of Most Per-
fect Being. (2) The Cosmological argument
was adapted from Aristotle, and proceeds upon
the principle that every effect must have a
cause. The world is such an effect. It is im-
possible to suppose that the series of natural
causes goes back to infinity, and consequently
we are compelled to assume the existence of a
Divine First Cause, adequate to account for the
existence of the world. (3) The Teleological
argument is based upon the evidences of design
in the world, and infers therefrom the exist-
ence of a designing mind as its Author. These
formal arguments were subjected to a destruc-
tive criticism by the philosopher Kant at the
end of the 18th century. He attempted to show
how they depended one upon the other, and all
contained contradictions and inconsistencies.
Kant held that the moral argument was the only
possible proof for the existence of God. This

IECA, théék'la, Saint, the female pro-
yr of the Church. Born of a noble
of Iconium in Lycania, she was con-
bys the preaching of Saint Paul, followed
Antioch and devoted herself to a life of
ity. As a consequence, she suffered a
of persecutions from her fiancé and her
, who eventually denounced her to the
ites as a Christian, and she was thrown
wild beasts in the theatre; but the fierce
is refused to hurt her, and she also es-
scathed from the flames to which she sub-
sequently exposed. After the death of
Paul she lived to a ripe old age in a cell
ecula. She is the heroine of a Chris-
ian of the 2nd century called 'The
Paul and Thecla.' (See Apocrypha).
It Schlavan, 'Die Akten des Paulus und die
acklagegende' (1877); Schmidt, C.,
Pau1i' (Leipzig 1905); Ramsay, 'The
1 in the Roman Empire' (London 1893).

IECOPHORA, a suborder of Chelonia
containing the sea turtles (E). It is defined by anatomical charac-
most conspicuous of which is the ex-
: possession of horny epidermal shields
tes on the shell. Consult Gadow, 'Am-
and Reptiles' (New York 1901).

IEFT, is a term sometimes used as sy-
ous with larceny, although it is less tech-
and a wider term, and signifies the secret
olious abstraction of the property of
r with the intention of converting it to
er's use, and without the consent of the
. See LARCENY.

IEINE, CH₄NO₃, more often called caf-
an alkaloid found in tea, coffee, Para-
tea, guarana, etc. It may be prepared
tically by action of methyl iodide on
mine. Usually obtained from tea dust
contains from 2 to 4 per cent white
needles, slightly soluble in cold water and
possessing a somewhat bitter taste, and
ng salts with acids. It is used in medicine
eve stimulant.
THEISS — THELLUSSON

argument maintains that the existence of right and duty presupposes the existence of a God who will ultimately proportion happiness to virtue and vice versa. Kant's criticism was effective in weakening the force of the above-mentioned proofs in their traditional formulation. Evolutionary science has also contributed to lessen the force of the cosmological and teleological arguments in their earlier and cruder statement. If the present complex condition of the world is the result of a slow process of development from a simpler condition, the need for a First Cause of the present world is less apparent. If present organic structures owe their existence to their utility (that is, are the result of natural selection), their purposiveness is explained by natural causes. But all such criticism, including that of Kant, is effective rather against the form than the substance of theistic argument. It has led only to a reconstruction of old arguments and their statement in a more adequate and convincing manner. Thus it would seem that the arguments for the existence of God are rather stronger than weaker, as the result of criticism. They only indicate in outline what form some of these arguments have taken in recent years. (1) Belief in God is justified by the needs of human thought. The constant endeavor of the human mind, in its thought, is to introduce more perfect unity, more completeness, into its knowledge. The idea of God by virtue of its all-inclusiveness, is required as the final instrument of organization to make this unity complete; for by it the self and the world are justified, the elements of one universal life. Thus the idea of God proves its own reality by its function in knowledge. (2) The existence of God is evidenced by the nature and development of the world. In the natural world we have a series of events related as cause and effect, and each dependent upon the other. Since each component part is dependent upon and determined by some other part, it is impossible to conceive the whole series as standing alone. It is rather by its very nature dependent, and requires for its existence and support some ground or underlying principle that is self-determined. From the nature of the world as dependent and relative, therefore, we are led to believe in the existence of an Underlying Principle that is self-determined and absolute. If we consider next the development which the natural world has undergone we see its culmination in man with his intelligence and civilization. The character of the underlying principle or ground of any process will, of necessity, be more completely manifested as the process unfolds. Thus the intelligence and personality of man, as the outcome of the natural order, reveal to us the intelligence and personality of its Ground. (3) The ideals of human activity, both theoretical and practical, presuppose the existence of a God. The thought of man has an ideal, Truth, for which it ever strives. Yet Truth exists in no single human mind, neither is it the possession of the race. Truth is universalizing the force of God. If it is true it must exist somewhere. We are forced then to assume a divine mind in which Truth exists in all completeness. The same is true of the good, the ideal of human conduct. That good which, as moral ideal, exercises absolute authority over all men, is relative neither to in-

dividual desires nor to the desires of a society of individuals. Here, too, we are obliged to assume a Divine Personality whose plans are realized in the moral order and whose purposes are represented in the moral ideal.


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THEISS, tis, or TISZA, tis'6, Hungary, the largest tributary of the Danube and one of the most important of the country, rises in the Carpathians, being formed by the junction of numerous small mountain streams. Its course is first northwest, then southwest and west until, after a circuitous course, it empties into the Danube. Its entire length is 800 miles, 300 of which are parallel to the Danube. The principal affluents are the Maros and Bodrog. The cities on its route are Tokay, Szolnok and Szegedin, which is frequently visited from a river steamer. A memorable inundation was that of 1879, when Szegedin was overwhelmed and the entire population lost everything; the loss including many lives. Tokay is at the head of navigation. A canal connects its lower course with the Danube while the Harda connects it with the Temezvar. Its basin has an area of 56,600 square miles, covering all the eastern part of Hungary and most of Transylvania.

THELLUSSON, tell'us-sôn (Fr. thél-lu-sôôn), Peter, London merchant; b. Paris, 27 June 1737; d. London, 21 July 1797. He settled in London in 1762 and opened a commission house, and later acquired a large fortune by trade with the West Indies. The singular terms of his will, dated 2 April 1796, gave occasion to the passing of an act of Parliament known as the Thellusson Act. He left to his widow and family about £100,000, and the remainder, amounting to more than £600,000, he left to trustees, to accumulate during the lives of his three sons, and the lives of their sons. On the death of the last survivor the estate was to be divided equally among his three sons and their legal descendants of his three sons then living. If there were no heir the property was to go to the extinction of the national debt. The will, being contested by the heirs at law, was finally established, by a decision of the Lords, 25 June 1805. An act of Parliament, however, was soon after passed (30th and 40th Geo. III, ch. 20), restraining the power of dividing property, for the purpose of accumulation, to 21 years after the death of the testator. Thellusson's last surviving grandson
 THEME — THEOBALD

356 and the final disposal of the prop-
not settled without an expensive and
1 lawsuit lasting until 1859; when in
see of miscarriage and with the
act on the surviving heirs received but a
ME, in music, is the subject or lead-
ly in a composition; in a fugue it is
dly repeated or imitated in the same
different key by the voices in parts.
In simple, themes are fewer

guised by groups of ornamental notes,
notations, which serve too often merely
off the performer's flexibility of voice

SS of fingers. See Music.

TS, the'mis, in Greek mythology, a

of Dionysus and Erato (Herm
b); according to some, of Helios, or
Possessed of the gift of prophecy she

in a dweller in the oracular temple

, but she left it to become consort to

by her the mother of the

Fates (Moires).
The of divine law and order, as established
ods, she relentlessly pursues all who

on the rights of others, and her

of justice is often

ed with her. She was honored at
Rhamnus, Delphi and other Greek
art she is pictured as a stately per-

with the cornucopia and scales.

J. E. 'Themis: A Study of the
'signs of Greek Religion' (Cambridge

Ritzel, R., 'Themis, Dike und Ver-

(Leipzig 1907).

MISTOCLES, than'tis-klez, Greek

ind statesman: b. Athens, about 514

, Asia Minor, 449 B.C. He

played unusual ability and great

e ostracism of Aristides in 483 was in

his influence, and he thereupon be-

political leader in Athens. He was

on eponymous in 481, and when the

vasion of Greece by Xerxes was

he obtained command of the Athen-

which through his exertions had been

the income derived from the Lau-

er mines. He contested to fight under

an admiral in the battle off Arte-

when, through neglect of his ad-

pass of Thermopylae was forced and

hordes overrun Boeotia and ad-

on Athens, he persuaded the Athen-

convey their women and children to

safety, abandon the city to the Per-

those capable of bearing arms to take

up. The exiles, among whom was

s were recalled and the command of

fleet was entrusted to a Spartan,

. The battle of Salamis (480) re-

a signal victory for the Greeks and

icles, to whom the success was mainly

became the leader not only of Athens

ecce. One of his greatest services to

ry was the skillful manner in which,

artful parleying with the

he gained time for the rebuilding of

of Athens. From this time the glory

of, it declined. He had gained the

the Spiritualism book on the costs of

strongly and he was now accused by

reasonable negotiations with the Per-

sians. He was acquitted of this charge, though

he was ostracized in 471 by his countrymen,

who had become aware of his unscrupulous

character and his inordinate rapacity, for

on which he was accused of gratifying by unjust

means. He retired to Argos, thence fled to

Epirus, and ultimately sought protection at the

Persian court, where he gained high favor with

the reigning monarch, Artaxerxes Longimanus.

He was deeply engaged in plans for the

domination of Greece by the Persians, which he

had promised Artaxerxes to compass, when,

knowing the impossibility of fulfilling his prom-

ises, according to some accounts, he took poison;

others, however, ascribe his death to natural

causes. His career shows a curious admixture of

opulent and sagacious statesmanship and sor-

did ambition. He was possessed of great elo-

quence and was undoubtably the savior of

Athens and Greece at the crisis of Salamis.

Consult Bauer, 'Themistokles' (Mersburg

1881); Grote, 'History of Greece' (1907);

Wecklein, 'Ueber Themistokles' (Munich

1892); or any standard history of Greece.

THÉNARD, ta-nár, Louis Jacques, French

chemist: b. Loupptiere, Champagne, 4 May 1777;

d. Paris, 21 June 1857. He studied at different

in Paris under Fourcroy and Vauquelin, becom-

ing the assistant of the latter, who procured

him a professorship at the Collège de France

(1804). Subsequently he succeeded Fourcroy

in the chair of chemistry at the Ecole Poly-

technique, as well as in his seat in the Academy.

In 1825 he was made a baron by Charles X
and in 1832 a peer of France by Louis Phili-

ippe. It was while attempting to verify a theo-

ry he had propounded in the lecture-room

that he made his important discovery of the perox-

ide of hydrogen. He worked with the chemist

Gay-Lussac (q.v.), and made noteworthy origi-

al investigations, including those of the com-

pound ethers, of bile and of sebaceous acid. He

discovered the method of preparation of a

cheap cobalt blue, since known as 'Thénard's

blue.' His chief publications are a 'Treatise

on Elementary Chemistry' (4 vols., 1813-16)

and 'Physico-Chemical Researches' (with Gay-

Lussac, 1816).

THÉNARDITE, a mineral identical in

composition with the artificial sodium sulphate,

Na₂SO₄. It is brittle, of vitreous lustre, white

color, transparent to translucent, hardness 2 to

3, and specific gravity 2.68. It crystallizes in

the orthorhombic system, often in tabular, cross-

twinned forms, with distinct basal cleavage.

It is entirely soluble in water; natural crystals

speedily absorb water and effloresce. It often

occurs dissolved in the waters of salt lakes,

from which it is separated in crystal form dur-

ing the summer season by evaporation.

The most important American localities of this
type are Borax Lake, California, and Rhodes

Marsh, Nevada. Vast deposits exist on the Rio

Verde in Arizona. It is of value in the prepara-

tion of soda.

THEOBALD, thëô-báld, Lewis, English

dramatist and Shakespearean scholar: b. Sirt-
inborough, Kent, 2 April 1668; d. London, 18

Sept. 1744. His classical attainments were con-

siderable and by 1715 he had published transla-

tions of Plato's 'Phaedo', the 'Electra',

'Ajax' and 'Edipus Rex' of Sophocles and

the 'Plutus' and 'Clouds' of Aristophanes. He
made attempts at verse and tragedy, but succeeded in neither. In 1725 Pope published his edition of Shakespeare and in 1726 Theobald appeared with a work entitled "Shakespeare Restored," in which he restored many of his fault readings as well as Amended as Unamended by Mr. Pope in his later edition of this Poet: designed not only to correct the said Edition, but to restore the true Reading of Shakespeare in all the Edible allusons that suggest the use of the manifoldly improved readings suggested by Theobald in his second edition, he never forgave the seeming of his incompetence as an editor and in the first edition of the "Dunciad" Theobald figured as hero. In 1733-34 Theobald published an edition of Shakespeare in seven volumes, in the preparation of which he had the assistance of Concanen Thirby and Warburton. Textual criticism of Shakespeare owes much to him, for he was the first to discard conjectured readings and in his emendations displayed knowledge, tact and good sense. Subsequent editors have depended much upon him and have adopted his corrections. At the time of his death he was engaged in a new edition of Shakespeare and Fletcher, six plays of which he had already completed. Consult Collins, "Essays and Studies" (London 1895); Nichols, "Illustrations of Literature" (Vol. II, pp. 204-654).

THEOBROMA CACAO. See Cocoa.

THEOBROMINA, C.T.11-N.O, a white crystalline alkaloid found in the chocolate prepared from the seeds of the cocoa tree. It forms salts with acids, is bitter, soluble in alcohol, slightly so in water. It is closely related to caffeine, the active principle of tea and coffee. In which it can be readily changed. Caffeine may be considered as theobromine in which one hydrogen atom has been replaced by the methyl group (CH3). It is not used to any extent in medicine, although it has a slight sedative action on the nervous system.

THEOCRACY (from Gr. Theos, God, and kratos, power) is that government of which the chief is, or is believed to be, God himself, and the laws the commandments of God. The priests in such a government are the promulgators and expounders of the divine commandments, as the representatives of the invisible Ruler. The most notable theocratic government of all times was that established by Moses among the Israelites. The Puritan government of Massachusetts was also called a theocracy, owing to the claim that it was conducted on the principle of obedience to divine laws, and the requirement that all should contribute to the support of the Church and attend church services.

THEOCRITUS, the-ôk'ri-ús, Greek bucolic poet: b. Syracuse, according to others at Cos, and flourished about 280 B.C. He was a pupil of Philatus at Cos. Having gone to Egypt, he was treated with much distinction by Ptolemy Philadephus, in whose praise he wrote Idyls 14, 15 and 17, but afterward returned to Syracuse, where he appears to have been in terms of some intimacy with Hiero II. We have under his name 32 idyls, or pastoral poems, of which, however, several are probably by other authors. The most doubtful are 12, 14, 15, 27, 28. He is to be considered the author of this species of poetry as a branch of Greek literature, though the elements of it existed before his time among the Dionysians of Sicily and Greece. Most of his idyls are dramatic form and consist of the altered courses of many short scenes, as well as the fresh and vivid pictures of life, common in Sicily, and are by considerable comic and, though not extent, tragic power. They are of a different sort from the altered compositions regarding the imaginary shepherds of Arcadia. Writing generally in the idyl, in two cases (Idyls 28, 29) in didactic, which is peculiarly adapted to the simplicity of rural life, his language is still harmonious. His metre is chiefly the hexameter. Besides the idyls he wrote a called "Berenice," of which only five lines are extant, and 22 epigrams (Greek Anthology). He was imitated by (g.v.) in the "Echoes" of Dryden's "Thebes to his has been well shown by, in chapter of the "Victorian Poets" (See Theocritus, Bion and Moschus). The best editions of his works (usually joined with Bion) are those of Meineke (1855); Wordsworth (new ed. 1877); Fritzschke (3d ed. by Hille, Leipzig. There are renderings into English by Chapman (1806) and Calverley (1849) and into prose by Lang (with introduction, New York 1880). The 7th and 8th are translated in verse by Leich (Hunt's "Honey," 1848). Consult, besides the mentioned works, Christ-Schmid, "Ger. Poet. Neurömische Literatur" (Vol. II, Munich 1911); Fritzschke, "Zu Theokrit Virgil" (1860); Knapp, "Thekritis u. Didymen-Dichtung" (1882); Wright, W. Short History of Greek Literature (York, 1907).

THEOCRITUS, BION, AND CHUS, Idyls of. Theocritus is one of the names contributed by Greece to the pantheon of pastoral poets, and to those后者 always been the "glass of fashion and the mold of form"—to Bion, to Bion, and to the English, Italian, Spanish and French of the Renaissance (and there were many who were pleased to write of shepherds, their loves and their lamentations. The flowers from which all the poets of Europe have sucked their being lived in Sicily in the earlier part of the century and. An epigram, written in prose, by some one else, says: "I, who wrote these idyls, am a citizen of the people, the son of Phyllina." It is important to note that the idyls, the poems that have come down under his name are 32 idyls, not always classified as bucolics, mimes, idylls and 20 odd epigrams. The poems that form the topic of this discussion are what we call the "Idylls" of Theocritus. It is probable that a few of these idyls are what we
hers are little pictures or sketches on subjects. His first idyl is dialogue in Thrysis and a goat herd, in which sings the famous 'Lament for Daphnis.' Second tells how a passionate, jilted attempts by magic rites to regain the her deserting lover. The next declares herd's love for Amarillis. These are contests between herdsmen. Two, VI I. are about the love of the Cyclops, us, for the sea nymph Galatea; ans about Hercules and Hylas. Two are eulogies on Hiero, lord of Syracuse, Ptolemy Philadelphia, king of Egypt. r XIX is a very brief poem that tells bee stung the little god Eros; and sev- hers are probably spurious.

Haps the most famous are the 1st, d 15th. The first because of the t for Daphnis, which served as a model on's 'Dirge of Adonis,' for Milton's is, for Shelley's 'Adonais' and Mat- t and Arnold's 'Thyris.' The second, in the as Sir Charles, bestial and col- ul, tragically, strangely humorous and ut- unforgettable, and has remained a unique piece in literature. The 15th is y the most interesting to English read- is certainly the most entertaining. Mat- Arnold calls it 'one of the best and t of Theocritus's idyls.' It is really a ay, of which the two chief dramatists per- e Syracusan women, living in Alexandria. mes to get the other to go with her to her to the honor of which the queen of Egypt has ar- with unusual magnificence. The cele- is to be in the palace, where a beauti- ure of Adonis is to be exhibited and a prima donna is to sing a hymn to life and Adonis. The two women and maids make their way through the d streets, squeeze into the palace with y and hear the hymn. The scene is felike.

It is mainly this quality of lifelikeness the bucolic idyls, distinguishes Theoc- rom Virgil and all his other imitators, ed not suppose that Sicilian shepherds spoke as Thrysis and Daphnis speak, or ce the less elegant Battus and Corydon. ecritus uses language not too far from t depicts the Sicilian country, with its and rustic objects, in a realistic way; s his imitators are all artificial, and especially during the Renaissance, usily so forsaking all semblance of scenes in which their Phyllisises rydons make love or lamentation might in Marie Antoinette's drawing room; shepherds drive their flocks afield in adors near Girgenti, or over the plains ania.

Translation of Theocritus can give more rude idea of the original. Strictly g, poetry cannot be translated; and in itation of Theocritus not only is the gone, but his words are so accurately that the translation is merely a translation of the 15th idyl is that in w Arnold's essay on 'Pagan and 'Religious Sentiment,' and for the other idyls, the prose versions by Andrew Lang. Edmund Clarence Stedman translated for, the I, X, XIII and XIX, following the hexameters of the originals. Many other translators in prose and verse have tried their hands, and some with a reasonable measure of success.

Bion is an imitator of Theocritus. Little that he wrote remains: there is the 'Dirge of Adonis,' half a dozen short idyls and some fragments; he himself is a shadow. From the poem, a 'Lament for Bion,' attributed to Moschus, it appears that Bion was born in Asia Minor near Smyrna, and possibly that he traveled in Thrace and Macedonia, also that he lived in Sicily and died by poisoning, and that Theocritus mourned him. But modern criticism denies that the 'Lament' was written by Moschus, denies the story of poisoning, and puts Bion about 150 B.C. The 'Dirge of Adonis' is by far the most celebrated of his poems; for if the earliest suggestion for 'Lycidas,' 'Adonais' and 'Thyris' comes from the 'Lament for Bion,' it certainly comes by way of the 'Dirge of Adonis.' The poem is a lament by Aphrodite over the dead Adonis; in part it is passionate to frenzy, with an element of Asiatic extravagance, but in other parts florid, pretty, elegant and artificial. His other poems, for the most part, are love songs, delicate, sweet and elegant.

Moschus seems more shadowy still. His fame is united to that of Theocritus and Bion, as one of the three chief pastoral poets of Sicily; and this union in renown has been strengthened by the common practice of publishing their works together. To Moschus were usually attributed six or seven idyls, 'Eros,' 'The Runaway,' 'Europa,' the 'Lament for Bion,' 'Megara, the Wife of Hercules,' and others. The 'Lament for Bion' is the poem on which his fame has chiefly rested. It represents the poet as Bion's pupil, and is framed upon the models of the 'Lament for Daphnis' and the 'Dirge of Adonis,' it is pathetic, delicate and imaginative. But the style is too contemporary of Theocritus, and seems to prove that the poem belongs to a later age. Modern criticism, therefore, takes away its authorship from Moschus and that of the Megara as well. Moschus himself is now believed to have lived at Syracuse about 150 B.C.

The authoritative text of 'Bion and Moschus' is that by U. von Wilamowitz-Moellendorff, 'Scriptorum Classicorum Bibliotheca' (Ox- ford 1905).

No translation of any of these poems gives more than a rough and ready idea of the original. The more imaginative the poet, the more delicate his workmanship, the less the translator can imitate him. This is as true of Bion and Moschus, or whoever wrote the 'Lament for Bion,' as it is of Theocritus.

HENRY D. SEDGWICK,
Author 'Essays on Great Writers,' etc.

THEODICY, a term of Leibnizian philosoph- in which the existence of physical and moral evil is made reconciliation with the exist- ence of a righteous God, the controlling provi- dence of the best of possible worlds. See LEIBNITZ.
THEODOLE. See Surveying.

THEODORA, the-ô-dô-ra, Byzantine empress consort of Justinian I; b. 548 A.D.; d. 548. She was, according to the dubious evidence of Procopius, the daughter of Acacius, a bear-ward at Constantinople, and had already been by turns actress, dancer and harlot, when she won the heart of the austere and ambitious Justinian, to become in succession his mistress, his wife and the sharer of his throne (527). Never thereafter did the fear of scandal touch her name; she became Justinian's trusted counsellor, bore a chief share in the work of government, and saved the throne by her high courage at the crisis of the Nika riots (532). "Now every man must die once," said she in council, "and for a king death is better than dethronement and exile." If you wish, O emperor, to save your life, nothing is coming; there are your ships and the sea. But I agree with the old saying that 'empire is the best winding-sheet.' She lavished her bounty on the poor. Consult Delbrueck, Antonin, 'L'Impératrice Théodora' (Paris 1885); Diehl, Charles, 'Justinien et la civilisation byzantine au sixième siècle' (Paris 1901). Théodora, impératrice de Byzance' (3d ed. Paris 1904); Gibbon, Edward, 'Decline and Fall of the Roman Empire' (ed. by J. B. Bury, Vols. IV and V, 1912); Mallet, C. E., 'The Empress Theodora' (in English Historical Review, Vol. II, London 1886).

THEODORÉ I, théô-dô-ré, of Corsica, otherwise Baron Théodore de Nenhoff, German adventurer; b. Metz, about 1696; d. London, 11 Dec. 1756. He was the son of a Westphalian nobleman and engaged in the French, Swedish and Spanish service successively. In 1732 he went to Florence as chargé-d'affaires for Emperor Charles VI, and taking part in a Corsican uprising against Genoa through funds furnished by the Bey of Tunis, was proclaimed king of Corsica in 1736. Soon after, however, he was driven to flight, but made two subsequent attempts to reinstate himself in 1738 and in 1743. In 1749 he settled in London, where his creditors put him in prison; but his release was purchased by the support of Walpole. By his wife, an Irish lady whom he robbed and deserted, he had one son known later as Colonel Frederick, author of 'Mémoires pour servir à l'Histoire de Corse' (1768). Consult Fitzgerald, 'King Théodore of Corsica' (London 1890).

THEODORE II, or NEGUS, king of Abyssinia; b. province of Kwarra, 1818; d. Magdala, 14 April 1848. Originally named Kasa or Kasai, he led a revolt in 1854 against Ras Ali, ruler of Abyssinia, whom he defeated. Later he was crowned, under the title of Théodorus, king of kings, of Ethiopia. He was a man of strong personality, an enemy of Islamism, a ruler and a reformer. He became intolerant of any power other than his own and with the queen-mother of Nubia took offense at what he considered slight. His quartel with Great Britain was brought on by the judicial conduct of the English consul, Captain Cameron, sent to him in 1841 and by the failure of the English government to respond to his overtures regarding the reception of his Ambassador at the English court. He finally imprisoned Cameron and also Hormuz Rassam, a Turk. English subject, sent to treat with concerning Cameron's release. As setting the prisoners at liberty Théodoroquested that certain skilled artisans be him, together with presents that he led to expect. The English detained artisans and presented at Magdala the release of the prisoners; but as they delivered up, war was declared, and a petition under Sir Robert Napier's progress toward Magdala in the latter 1867. The city was reached, and active hostilities began on 10 April 1868. On the 11th city was taken and Théodoro was fc. The besiegers were informed that he had committed suicide. See Abyssinia and British and Theodora, ecclesiastical writer; b. Antioch, about 428. He studied rhetoric under Libanius in Rome and Andragathius and sacred ture under Flavianus of Antioch, Dioscorus and others. Early in life he fell of his fellow-student and chief mate, John Chryssostom, whom he admired, although he had been on the point of ing a lady of Antioch named Hermione, being ordained priest he distinguished himself as an opponent of Arians. From Antioch he removed to Tarsus, a city of about 392 was chosen bishop of Mopsuestia. In 394 he preached before the Emperor at Constantinople and was present the council held in that city at that time was a voluminous writer, the most imp works being commentaries on and polemical treatises. These were In great repute among the Syrian churches many of them were translated into Arabic and Persian. His views appro in the Eastern Church, he was condemned as a heretic at the Ecumenical Council, held at Constan 553. For fragments of Théodora's works, Migne, 'Patrologia Latina'; J. M. Consul and also Harnack, A., 'History of Christianity' (Vols. III, IV; Boston 1898); Kühn, 'Dero w von Mopsuestia' (Freiburg im Breisgau); and Piercy (eds.), 'Smith's Dict. Christian Biography' (Boston 1913). W. Symes, 'Syria Literature' (London 1894).

THEODORÉ, théô-dô-ré (Đowq), church historian and thebian writer; b. Antioch, late in the 4th century. He was educated in a monastery Antioch, where he had Nectarius and of Antioch for fellow-pupils. After study and retirement he succeeded (423) as bishop of Cyrus, a city at days' journey from Antioch. He endeavored to play the part of mediator between and Cyril of Alexandria, but could not reconcile the two. He was by the Council of Ephesus, an act which of his consecration against, but excused. When the Nectarians were with relentless severity, he stood for their champion. He was the successor of Dioscorus. The latter accused Nectarianism, pronounced a anathema upon him in the church of
andria and (449) procured his deposition at the th-called robber council of Ephesus, a sentence which was reversed by the general council of Chalcedon (451). The most important of his works, of which a complete edition was published by Schulze and Nösselt (1769-74), consist of commentaries on the Old Testament and his 'History of the Church.' In five books, beginning with the history of Arianism under Constantine the Great and ending with the death of Theodore of Mopsuestia; 'Religious History,' a narrative of the lives of the hermits, called the Fathers of the Desert; 'Eranistes,' three dialogues against the Eutychians, and 'History of Heresies.' Consult Binder 'Etudes sur Théodoret' (Geneva 1844); Gaisford, 'Theodoreti Historia Ecclesiastica' (1854); Harnack, A., 'History of Dogma' (Vol. IV, Boston 1896); 'The Nicene Fathers' (ed. by Schaff and Wace, Vol. III, New York 1892).

THEODORIC I, theód’o-rík, king of the Visigoths. He was chosen successor to Valamara (456) and extended his kingdom, especially so as to embrace the neighboring Roman cities of Arles and Narbonne. For this purpose he made war against the Romans after the death of Honorius in 423 and continued with varying results until 437, when he entered into an alliance whose exact terms are unknown. By 450 he came into closer alliance with the Romans in the endeavor to check the advance of Attila, who led his barbarian army across Lorraine and captured the city of Orléans. Theodoric and Aëtius, the Roman general, encountered Attila near the village of Moirey, a few miles from Troyes, and fought the battle generally known in history as that of Châlons-sur-Marne, in 451. Theodoric was killed by an arrow; but the progress of Attila was checked and western Europe was saved from the domination of barbarism.

THEODORIC II, son of Theodoric I. He was a member of the party who wished to remain on terms of peace with Rome and was chosen successor of his father. Tho- reo2ed Theodoric I, began to levy war against the Romans he took part in a rebellion that ended in the murder of Thorsmund and his own elevation to the throne. As vassal of the Roman emperor Aëtius he made an expedition against the Sueves, conquered and put to death their king and was in a fair way of completing the conquest of Spain, when Aëtius was deposed and killed and Theodoric ceased his efforts. In 466 he was murdered by his younger brother, Euric.

THEODORIC THE GREAT, king of the Ostrogoths: b. about 454; d. 526. His father, Theodemir, was one of the three brothers who jointly ruled the Ostrogoths settled in Pannonia, and he sent him, when only eight years of age, to Constantinople as a hostage, to secure the conditions of a treaty between the Goths and the Emperor Leo. After residing 10 years with that emperor he was restored to his father, then sole monarch of the Ostrogoths. On the death of Theodemir, and being indignities set on him, he began a course which, after menacing the safety of the Greek empire, and Constantinople itself, terminated in an expedition against Odoacer, who had assumed the title of king of Italy. After several bloody engagements, the latter was finally induced to yield, on condition that he and Theodoric should govern Italy with equal authority (493). The murder of Odoacer at a banquet soon followed this agreement; on which Theodoric caused himself to be proclaimed king of Italy, and he governed with extraordinary vigor and ability. He attached his soldiers by assigning them a third part of the lands of Italy, on the tenure of military service; among his Italian subjects he encouraged industry and the arts of peace. He improved the administration of justice, issued edicts to protect the public monuments at Rome and elsewhere, and assigned revenues for the repair of the public edifices. Like his ancestors he was an Aribean, but was indifferent to controversy and never violated the peace or privileges of the Roman Catholic Church. The particulars of the government of this memorable prince, who shed a short-lived lustre on the Gothic name, are recorded in 12 books by his secretary, the senator Cassiodorus, a learned, who induced his illustrious master to become a patron of letters. The senators Boethius and Symmachus were both put to death on the mere suspicion of an intrigue between a senatorial party and the imperial court. This cruel act had no sooner been perpetrated than Theodoric was seized with remorse, and a fever ensued, which terminated his life in three days. The ordinary residence of this king was at Ravenna, above which city his daughter Amalasuntha erected a splendid monument to his memory. Consult Dahn, Felix, 'Die Könige der Germanen' (Vol. III, Würzburg 1886); Gibbon, Edward, 'Decline and Fall of the Roman Empire' (Vol. IV, ed. by J. B. Bury, London 1912); Hodgkin, Thomas, 'Ostrogothic Invasion' (in 'Italy and Her Invaders,' Vol. III, London 1885); id., 'Theodoric the Goth' (New York 1893).

THEODOSIA. See PEDEOSIA.

THEODOSIUS (thód’é-dó’shi-ús) THE ELDER, Roman general: d. Carthage, 376. He was the father of the empress Eudocia (q.v.), called "The Great." By birth a Spaniard, he rose to high rank in the Roman army and in 367 was sent by Valentinian I to Britain, where he repelled the invasions of the Picts and Scots, strengthened the military defenses and restored order. He formed the country between Hadrian's wall and the Forth and Clyde into a new province, which he named Valenti, and then returned to Rome. He was later stationed on the Upper Danube, where he was victorious over the Alemanni, and in 376 quelled the revolt in Africa led by the formidable Moorish chieftenant Firmus. He was beheaded at Carthage in 376 by order of Valens, on some unknown and probably unjust charge.

THEODOSIUS (surnamed THE GREAT), Roman emperor: b. Spain, 347; d. Milan, 17 Jan., 395. At a very early age he obtained a separate command; but on the execution of his father he sought retirement, until selected by the Emperor Gratian, in 379, for his partner in the empire. To his care were submitted Thrace and the East, and he was delivered from an invasion of the Goths, whom he signally defeated in two battles, concluding a peace with them in 382. On the defeat and
death of Maximus at Aquileia (388) he became the sole head of the empire, Gratian having been previously killed in the war against Maximus. He administered the affairs of the West in the name of Valentinian, the son of Gratian, then a minor. He entered Rome in triumph in 391, and passed three years in Italy. In 396 a sedition took place in Thessalonica, which resulted in the murder of the governor and several of his officers. The resentment of Theodosius was natural and merited; but the manner in which he avenged it was in the highest degree detestable and inhuman. An invitation was given in the emperor's name to the people of Thessalonica to an exhibition at the circus, and when a great concourse of spectators had assembled they were massacred by a body of barbarian soldiery to the number, according to the lowest computation, of 7,000. Theodosius was at this time at Milan, of which Saint Ambrose was bishop, and this prelate, on account of such an atrocious proceeding, resolutely refused to recognize it for eight months. About this time the emperor crowned his merits, as a foe to paganism, by demolishing the celebrated temple of Serapis and all the other heathen temples of Egypt, and he issued a final edict prohibiting the ancient worship altogether. On the murder of Valentinian by Arboagastes and the advancement of Eugenius in his place (392), the emperor carried on a war against the latter, which finally terminated in his defeat and death. Theodosius did not long survive this success.

Consult Gibbon, 'Decline and Fall of the Roman Empire' (London 1912); Hodgkin, T., 'Italy and her Invaders' (Oxford 1892).

THEODOSIUS II, Roman emperor, son of Arcadius and grandson of Theodosius I; b. 401; d. 450. He became emperor in 408, but proved a weak ruler, and the actual government was in the hands of his sister and of his wife during the greater part of his reign, in which the Theodosian code of laws was compiled. He was killed by a fall from his horse and was succeeded by his stepson, Pulcheria.

THEODOSIUS III, emperor of Constantiople. He held the unimportant post of collector of the revenue when he was nominated to succeed Anastasius, and he was crowned in 716. He resigned in favor of Leo the Isaurian in 717 and retired to a monastery. Consult Gibbon, E., 'Decline and Fall of the Roman Empire' and 'Cambridge Mediaeval History' (Vol. I, New York 1911).

THEOGONIS (thé-'og-nís) OF MEGARA, Greek elegiac poet. He lived between 540 and 500 B.C. There are 1,880 verses preserved under his name, of importance in enabling us to understand the state of parties and the problems of society in the Greece of that time. They were translated by Frere (1842) and are found in the original in Bergk's 'Poetae Lyrici Graeci' (1813).

THEOGONY, a poem treating of the generation and descent of the gods. The most ancient Greek theogony known to us is that of Hesiod, the earlier Theogonies of Musaeus and Orpheus having perished.

THEOLOGICAL DETERMINISM. See DETERMINISM.

THEOLOGICAL EDUCATION. See EDUCATION, THEOLOGICAL.
ality of the Christian religion. Anyone, re, who regards himself as scientifically id to accept these tenets, on the score of preponderance of evidence in their be ill of necessity be convinced that he ful demands of a scientific theology in tak or more than one faith to one. Such that Aristotle was often cited under the simple designation of the philosopher. In the modern period the Cartesian philosophy, the Leibniz-Wolffian, the Lockian, the Kantian, the Hegelian and others have unmistakably claimed spheres of influence in the theological domain. It appears, therefore, that a discreet choice of philosophical affiliations is the best that theology can do. It may enter into too close an alliance with a specific philosophy. It may fail to observe the due balance between a speculative bent and a sane regard for historical data. But it will and must draw largely from the resources of philosophy if it is to be fundamental and comprehensive.

A further question on the scope of theology concerns the relation of this branch to the domain of natural science. That a relation obtains to which a measure of significance may be attached is undeniable. It is not to be overlooked, however, that the field of natural science comes into less extensive contact with theology than does the field of philosophy. In so far as science moves in a physical or sub-human range, it touches upon matters that are of only subordinate theological import. It may enforce a revision of the theory of creation which has been read into or elicited from the biblical narrative; but of how small theological consequence is a conclusion on the precise method of creation, so long as God in his absolute supremacy and man in his dignity and worth are left to the contemplation! It may enlarge the view of the operation of secondary causes in the production of organic forms, and so may require some modification of the putting of the argument from design; but that involves no challenge to any theological tenet or interest, since the vast range of orderly results in nature must still be seen, as many of the most eminent naturalists confess, to demand ultimately an ordering intelligence. In short a close scientific examination of the subject will reveal that the findings of the physical sciences can neither displace the foundations of the central tenets of theology nor supply foundations to these tenets. Their function is exhausted in modifying one and another peripheral matter or adjunct of the theological system. Probably the greatest result which has come from that quarter is an offspring of the doctrine of evolution and consists in an enlarged tendency of the theological mind to expect, in relation to the kingdom of God in the world, tokens of the law of consecration and graduated progress. Undoubtedly the theologian does well to take note of the approved findings of natural science; but large expectations of contributing from that quarter to the task of ex tent to be fulfilled. It is in the constitution and experiences of man, and in the philosophical interpretation of both the world of nature and of personality, that theology must find its principal basis. Among the human experiences that make up the substance of sacred history may of course claim a distinct primacy. In other words, the Bible may be rated as the foremost treasury of theological data.
THEOLOGY

Scientific Value and Rank.—One and another system of theology, as actually developed, may be remote from a scientific character. But intrinsically scientific construction is just as feasible and appropriate in the field of theology as in any other field. Where a contrary impression has been obtained it has generally been due to one of three causes. Either the aogistic axiwm that religion has the unknown for its proper field has been adopted, and in consequence theology, as the theoretical side of religion, has been put up as a peer of substantial foundation; or theology has been associated with arbitrary authority; or a strained antithesis between reason and faith has been contemplated.

As respects the maxim which embodies the first of these grounds of objection, it must be pronounced a gratuitous negation of religion. It is a negation of religion, for sheer mystery offers no means of attachment. In the words of Pfeiderer, a religion of nothing but mystery is an absurdity. The maxim is also perfectly gratuitous. As John Fiske has said: None can deny that religion is the largest and most ubiquitous fact connected with the existence of mankind upon earth. It is so vast a department of human experience as to be regarded as by no competent ty supply any valid grounds of induction. Are the concurrence of thoughts, aspirations and satisfactions of the elect spirits of the race to be rated as void of all rational suggestions? Is not the sure basis of conviction to be found in the illuminated and transcendent consciousness of the Christ? Such questions need no formal reply. Theology doubtless has a great border-land of mystery. And so has biology. Indeed it is characteristic of most of the sciences that they impinge upon mystery. Alongside a domain of certainty they include areas which can claim at best only a high degree of probability. On the score of mystery, therefore, no good reason is apparent for expelling theology from scientific fellowship.

The second ground of objection of the scientific character of theology is sufficiently met by the affirmation that arbitrary authority is an interloper in the theological domain. If it has ever intruded itself here, it has been in the exercise of rank usurpation. Theology in its true character has no partnership with arbitrary authority. While it may make large account of positive revelation, it does not turn that revelation into a fence against investigation but uses its content for what it proves itself to be under the tests of mental scrutiny and prolonged application to the exigences of man's deeper life.

To the third objection a reply of similar tenor is to be made. The assumption of an antagonism between reason and faith, and of an obligation to sacrifice the former to the latter, is an assumption which a sane theology must emphatically repudiate. It is very true, doubtless, that a conflict of thought or any more than theory can take the place of action. But it is equally true that faith cannot endure to be in known antagonism to reason. An asse } which, from the standpoint of one denomination, is to be sanctioned by reason, is no real assent. Only that which is competent to take captive man's rational personality is able to induce a faith that is anything more than a sham or a shadow. Quite as much as any other branch of learning theology is free to emphasize the rationality in faith. The challenge of the scientific character is thus seen to fail as each of the cardinal objections mentioned.

In an unbiased valuation of theology, an association will not be made between substance and form. It is not incompatible with a variety of forms, in no wise rejection against a poetic garb. It is the picturesque discourse of the scholastic form, they are deeply, theology finding all their backgrounds of the most pronounced conceptions of God as well as the most beautiful that was ever before the contemplation of man. All religious discourse which is to avoid the charge of mannerism and impotency must in line with a substantial theological content. As Brooks has said, No exhortation to a god that does not put behind it some truth as to eternity, can seize and hold the conscience. Even in its formal character theology must be rated as second in interest to no degree of thought and study. The facts and with which it more directly deals are the est in man's being and the highest about human plane. It utilizes and gives a significant findings of a large proportion of the of learning. It takes into consideration the greatest treasures of past history, and it up the data for the fairest possible into future destiny. It gives ample for speculative accept, but at the same ti includes the themes that are of all the more tensely practical.

The Organic Arrangement of Matter.—The best arrangement of the divisions and branches of theology is one the one which is characterized by simp well as by comprehensiveness and self- eney. The very subtle scheme is likely to its inventor in a much higher degree the theological world at large. Among plans which meet in good measure combined demands of simplicity and comprehensiveness those of Henrici and H. are worthy of special mention. The draws a distinction between historic and normative branches, the one include the specifically biblical branches as the history of Christianity since b times, and the other comprising, as p subdivisions, Systematic Theology and Practical Theology. The idea of the last branches is to exhibit the whole do religious truth and fact; the idea of theative branches is to afford means of guide religious teaching and work. That there certain fitness in the distinction between two lines of study is undeniable. Still tinction is not beyond criticism. ( accredits a high degree of authority, libel may well be reluctant to each designation of an or of a branch in other biblical branch. Especially may _ tate to exclude that designation in Domatin. In view of this I to Henrici's nomenclature of Haugwirth — which is not of the logical domain between Exegetical, Hist- tematic and Practical Theology — Iarded as having at least an equal a pretension. Aside from its intrinsic motive for giving this plan the praven}
Systematic Theology, which has, in its Christian character, the office of furnishing an orderly presentation and justification of the whole body of teachings or beliefs which belong to the Christian religion, includes three principal branches, namely, Apologetics, Christian Dogmatics and Christian Ethics. It may also include Biblical Dogmatics, Polemics and Trensic, though the subject matter covered by these titles can conveniently be appropriated within other branches. An auxiliary to Systematic Theology of special significance is found in the Philosophy of Religion. Of the several branches named, Christian Dogmatics is so far central and prominent as often to be styled Systematic Theology. Being free to gather its evidence from every field, and aiming to present in organic form the whole doctrinal content of the true religion, it commands in the field of theology the maximum intellectual interest.

In Practical Theology the leading branches are Liturgics, Homiletics and Pastoral Theology. The last named is of wide compass, including besides the general theme of pastoral care such subsidiary branches as Catechetics, Ecclesiastical Polity, Ecclesiastical Discipline, and Theory of Missionary Work. Recently the interest in sociological study has created a motive to subjoin a branch which might be entitled Christian Sociology.

Prominent Stages and Representatives.—In the broad view three great epochs in the progress of theology are distinguishable, namely, the Greek, the Latin and the Modern. The last might also be called with relative propriety the Protestant, since the motive-power for its developments has been supplied in large part from within the domain which bears that title. The development of the Latin type was in part contemporary with the shaping and manifestation of the Greek type; still the former appears clearly second in order, since its initial stages were synchronous with the culminating stages of the latter. Greek theology had run its course and come essentially to a standstill before the more characteristic systems of Latin theology were elaborated by the medival scholastics. The two undoubtedly had very much in common. The same great creeds were acknowledged in the Latin church that had been obtained in the Greek division of Christendom, and the dogmatic grounds which were alleged ultimately for the severance of fellowship were of subordinate import. Still Greek theology stood in measurable contrast with Latin. It took on the whole a more general view of the divine relation to the non-Christian world. It was less inclined to a sombre conception of man’s native guilt and moral impotency. It accentuated to a special degree the thought of a divine incarnation and of the intimate connection between God and man provided for by means of the incarnation. The same thought was by no means foreign to Latin theology, but in its domain it was given, relatively speaking, less prominence, since it was made to share the field with the greatly emphasized conception of divine rulership. The standpoint of the one affiliated with a mystical theory of an interior life; the standpoint of the other was more legal and governmental. Both admitted the ideas of priestly mediation and efficacious, at least after the initial stage; but it
accorded with the genius of Latin theology to work out the most consummate expression of these ideas in a thoroughly elaborated hierarchical and sacramental system. In the one authority came to be regarded as specially residing in the creed and formulas of the past, in the other great prominence came to be assigned to the hierarchy, and especially to its head, as the perpetual embodiment of infallible authority. While this line of contrasts may legitimately be affirmed, it is to be understood that one and another point of difference cannot be taken too strictly, since in neither the Latin nor the Greek domain was theological thinking entirely uniform or homogeneous.

The Protestant era was initiated in a revision of the principle of authority which had been transmitted in Latin Christianity; and a fundamental feature of the theological activity of that era has consisted in carrying out this revision to its logical results. Original Protestantism, accepted in common with the Latin communio the great outlines of doctrine contained in the ancient creeds, especially the Nicene and the Chalcedonian. But it accepted them upon a revised basis. What was that basis? In the last analysis it must be defined as the principle of free rational induction, in opposition to the principle of judicial determination by official authority. The primary appeal was indeed to the scriptural content and to the doctrine of justification by faith. But since no infallible tribunal was set over the Scriptures, the appeal thereto amounted practically to a transference of the main emphasis to the free rational process. As respects the doctrine of justification by faith, it looked evidently in the same direction, since it profoundly qualified the necessity of priestly mediation or of dependence upon the hierarchy. The assertion of this revised conception of authority, it is needless to say, was not designed to imply any challenge to the idea of supernatural revelation. Logically, too, the Protestant principle involves no necessity to challenge that idea. What it shuts out is official monopoly of revelation and authoritative determination of its import by official prerogative. In place of this it installs, as the proper ground of theological convictions, free rational induction over the Scriptures which, if properly carried out, must take full account of the data of history, reason and experience. The advocates of the Protestant principle admit the great difficulty of the task of ideal theological construction on the basis of that principle; but it is their conviction that exemption from the labor of a thorough-going induction ought not to be sought in the religious sphere any more than in other spheres. The seeking of relief in the attachment to some perpetual office in the Church they regard as quite useless and mistaken, since it is less difficult to accredit, on the basis of history, reason and experience, any worthy element of belief, than it is to prove the continuous existence of an infallible tribunal.

In a closer review of the progress of theology it would be necessary to notice a number of significant developments in each of the great epochs mentioned. Account would need to be taken of the, e.g., Alexandrian, the Cappadocian, the later Alexandrian and the Antiochian schools in the Greek Church. In relation to the Latin Church attention would need to be given to the long history of the antithesis between Augustinian and anti-Augustian tendencies; to the struggle between Jansenism and Jesuitism; to the conflict, between papalism and antipapism. Within the Protestant domain there would be occasion to consider the early creative period of the Lutheran theology; the scholastic period in the 17th century; the Pietistic and Rationalistic movements in Germany; the implication of Lutheranism with successive philosophies since the dawn of the 18th century; the controversies between Calvinism and Arminianism; the contrasts between High Church, Low Church and Broad Church parties in the American Establishment; the wide-reaching tendencies born of the Wesleyan revival; the initiation in Germany of the great movement of biblical criticism and its extension to other countries; and the rise and influence of the Ritschlian theology.

Among theological writers eminent for their representative position, or breadth of influence, or both, we may specify, in the Greek Church, Origen, Athanasius, Basil, Gregory of Nazianzen, Gregory of Nyssa, Cyril of Alexandria, Theodoret and John of Damascene; in the Latin or Roman Church Augustine, Anselm, Peter Lombard, Alexander Hale, Albertus Magnus, Thomas Aquinas, Bonaventura, Duns Scotus, Suarez, Bellarmine, Petaius and Pezron in the Lutheran Church, Luther, Melanchthon, Chemnitz, Gerhard and Schleiermacher; in the Reformed Church on the Continent, Zwengli, Calvin, Bullinger, Turretin, and Arminius; in England and her dependencies, Hooker, Chillingworth, Pearson, Bull, Baxter, Owen, Howe, Butler, Wesley and Edwards.

Day Theology; Strong, (Sys-
); van Oosterzee, 'Christian

HENRY C. SHELTON,
'matic Theology, Boston Uni-

STUS, Greek philosopher, was a student of Plato and
ote as head of the Peripatetic
shy. He conducted the school
for 35 years, and was highly
and abroad. He was greatly
ral history and won renown
on botanical subjects. His
Ts and 'Theoretical Botany'
also are fragments of his
logy, 'Fire,' etc. His best
'Characters,' a series of
as repeatedly been translated.
', 'Aristotle and the Earlier
ng. trans., London 1897';
eek Thinkers? (Vol. IV, Eng
New York 1912) and others.
table edition of 'Characters'
Leipzig Philological Society

See GEOMETRY.

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IF ASSEMBLAGES. See

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IF CURVES. See CURVES OF

IF EQUATIONS. See Equ-

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LEX VARIABLE, GENERAL THER-

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stists, and in the speculations
, Eckhart and in the teach-
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ius and Plotinus, Simon
ion of Tyana, Paracelsus
represents a body of tradition
erved from earliest times
d in the philosophic and
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nt that the modern movement
 was to stem the tide of mate-rialism and agnosticism, which
then threatened to engulf the
ought of the age, and to stimu-
te transcendental research. Doubtless the
' chief and most authoritative
ement of the ends which the modern
osophical movement
were intended to accomplish is to be found in
the following letter written by one of those
adepts to one of his Western pupils:

4You can do immense good by helping to
give the Western nations a secure basis upon
which to reconstruct their crumbling faith. And what they need is the evidence that Asiatic psychology alone supplies. Give this and you will confer happiness of mind on thousands. . . . They have been charged with this current impulse which must soon come, and which will push the age toward extreme atheism, or drag it back to extreme sacerdotalism, if it is not led to the primitive soul-satisfaction of the Aryans... You and your colleagues may help to furnish the materials for a needed universal religious philosophy; one impregnable to scientific assault, because itself the finality of absolute science; and a religion that is indeed worthy of the name since it includes the relations of man physical to man psychical, and of the two to all that is above and below them. . . . Its (the society's) chief aim is to extirpate current superstitions and skepticism, and from long-sealed ancient fountains to draw the proof that man may shape his own future destiny, and know for a certainty that he can live hereafter. Since then a considerable literature has sprung up within the society, which, it is believed, has had the consent and active support of the closing decades of the 19th century and made possible the almost popular interest in the unseen world. Among the leaders of theosophical thought after the death of Madame Blavatsky, were Mrs Annie Besant, C. W. Leadbeater, A. P. Sinnett and G. R. Mead. — Mrs. Besant being Madame Blavatsky's successor in the esoteric as well as in the exoteric work of the society. Through the writings of these theosophists the so-called theosophical theories, which for centuries have seemed vague and speculative, besides being greatly amplified, have been presented in a form more definite than at any other time in the history of such thought, the teachings now no longer resting upon tradition and intuition, if indeed they ever did wholly so, but largely upon investigations made into the supra-physical realms of nature by highly developed men whose trained powers enable them to receive hallucinatory or what are called Adept's or Masters of, not solely of any one nation, but of any of the advanced nations— who have gained these divine powers in their fullness; that they exist now as in the past; that the Earth is the world of man, so far as the laws and conditions of our own solar system extend, and that their high state of progress enables them to advancement beyond human evolution, but that they of their own will can bring about changes of humanity in physical manifestation, that they may aid in its evolution; that it is from the brotherhood of these great adepts that from time to time have come into the outer world the great world teachers and that in their keeping has been the Wisdom-tradition, which in every age they have carried: the basic form; that there have always been pupils of these men, and that theosophical teaching is published to the world to-day at their instigation and through a few of their pupils; that the existence of a very subtle order of nature far finer than the ether which transmits light, upon which is impressed photographically, so to speak, in the form of living pictures, every scene or happening, however great or small, which has ever occurred from the very beginning of things and throughout the extent of the universe; that to this subtle material has been given the name of the Akashic Records, or the Memory of Nature; that not only does the trained observer who has acquired the power of sensing these conditions of the subtle medium of the universe, or of responding sympathetically to its vibrations, see vividly the particular occurrence to which he turns his attention, but he hears and feels, etc., just as he did the actors in any play; that they may be under review, perceiving their thoughts and feelings as well as seeing and hearing the outward conditions of the scene; that thus he can accurately, in proportion to his powers of observation, perceive any occurrence of the past, no matter when it may have happened, and in this way can know the true events of history; that he may also direct his vision to any period in the life of a planet and trace out its various evolutionary processes, and that he may thus enter a limitless field of observation wherein he may learn at first hand of the obscurer laws of nature; (c) that by the exercise of their highly evolved powers the Adepts or Masters of Wisdom can make definite experimental research into the Akashic Records in quite a real sense as the physicist makes his investigations within the physical world, and that they are, with these and other powers possessed by them, enabled to ascertain and teach certain general principles as definite and exact, all of which are now and have ever been known to them, and very many of said facts have to a more or less extent, been proven by the investigations of those of their pupils who have fitted themselves to do such work. In 'The Secret Doctrine' Madame Blavatsky mentions three such principles as being the fundamentals of theosophy; they are:

1. An Omnipresent, Eternal, Boundless and Immutable Principle, on which all speculation is impossible, since it transcends the power of human conception and can only be dwarfed by any human expression or similitude. It is beyond the range and reach of thought—unthinkable and unspeakable.

2. The Eternity of the Universe in toto as a boundless plane; periodically the playground of numberless universes incessantly manifesting and disappearing called the manifesting stars, and belonging to Eternity in toto.

3. The fundamental identity of all souls with the Universal Over-Soul, the latter being itself an aspect of the Unknown Root; and the obligating paterime for every soul—a spark of the former through the cycle of incarnation or necessity, in accordance with the cyclic and Karmic law, during the whole term.
io genesis.—According to the theosophist manifestation has its origin in the Ab-f of mankind, a concept that warns of the limits of human knowledge. As Mrs. Besant points out, his Ancient Wisdom, *Coming forth in the depth of the One Existence, from beyond all thought and all speech, a sphere embracing the nature of His own Being, the Manifested God, and tracing the sphere of His activity, thus outlines of His Universe. Within that sphere is born, is evolved and dies; it moves, it has its being in Him; its His emanation, its forces and energies of His life; He is immanent in all, pervading, all-sustaining, all-; He is its source and its end, its object, its centre and circumference, as the sages of the Ancient Wisdom teachings, the beginning of the manifestated Force out of all Being, the second, manifesting the two as life and form, the primordial duality, made possible of nature, between which the universe is to be woken—Life-Form, the, Positive-Negative, Active-Receiver, Mother of the worlds. Then the Logos, the Universal Mind, in which typically exists, the source of beings, the life of the Logoi, the treasure, which are stored up all the archetypal are to be brought forth and elaborated of matter during the evolution, universe. These are the fruits of the Logoi, brought over as seeds for the From the Third Logos comes forth Great Logoi, sometimes called the sirs before the throne of God; and as outbreathing! pours itself ever further and downward, from each of that we on the next plane Seven Logoi also, making up on that plane 49. Omit detail of intermediate hierarchies, it that to each of these 49 Logoi belong of the system: the vegetable, the animal, and the human. On the downward arc of its mighty curve this monadic essence simply aggregates round itself the different kinds of matter of the various planes, so that all may be accustomed and adapted to act as its vehicles; but when it has, lowest point of its evolution or immersing in matter and turns to begin the grand upward sweep of evolution toward divinity, its object is to develop consciousness in each of these grades of matter in turn, beginning with the lowest. When in the highest animal life this monadic essence or evolving soul mass reaches the ultimate limit of evolution in that type of forms, it is met by a third outpouring of Logic energy, that of the third Logos of the system, called the First Logos, resulting by this union in the formation of the numberless human Egos—the individualization of the One Self in man. It is the presence within man of this third outpouring of the Divine Life, this spark of the One Self, that guarantees to us immortality, which, from this point on, the Ego, all matter, so that when electrified by the atoms of the various planes develop all sorts of previously latent attractions and repulsions, and enter into combinations, he Ancient Wisdom, *Coming forth in the depth of the One Existence, from beyond all thought and all speech, a sphere embracing the nature of His own Being, the Manifested God, and tracing the sphere of His activity, thus outlines of His Universe. 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or real man, wins through innumerable incarnations in physical bodies.

As the worlds are septenary in their constitution, so also is man. He has on the physical plane (1) a physical body, the dense or visible portion of which is composed of solids, liquids and gases, and the etheric portion of which is formed of the four subdivisions of ether. Pervading these is (2) vitality, derived from the sun and specialized by the etheric part. On the astral plane he has (3) an astral or desire body. And on the lower four levels of the mental plane he has (4) a mind body. These four principles constitute the personality, or what is often called the lower quaternary. On the three upper levels of the mental plane he has (5) a causal or higher mental body, the storehouse of all his experiences, past, present and future; on the Buddhist plane, (6) a buddhic or bliss body, wherein the inherent unity of all life is directly perceived, not as an intellectual concept, but as a sublime experience, and on the nirvanic plane he has (7) the cosmic or Atman body, the body of absolute reality. These last three constitute the Reincarnating Ego, the individuality, the soul which lives and grows throughout the period of solar manifestation. The other two planes may be termed the planes of the Self, or pure spirit.

The matter of the various planes of nature entering into the composition of man's sundry bodies is vivified with the involving life of the monadic essence, the law of whose progress is to sink deeper and deeper into matter, while the law of the evolution of the Self using these bodies as vehicles of his consciousness is upward and out of matter. This apparent opposition of forces in man gives rise to the usual ideas concerning his lower and higher natures, and explains the meaning of evil. One's desires, thoughts and emotions are not himself, but the changing phantasmagoria of the living essence of his lesser vehicles which it is his business to learn to control and purify, until they become perfect instruments for the action of the real man within is none other than the changeless, eternal Self.

When the human Egos began their long pilgrimage of incarnations they at first took bodies on planets other than the one on which we now live. There are in our solar system seven planetary schemes of evolution, each the realm of a planetary Logos, and they are called, in the order of their distance from the sun, (1) the Neptune scheme, (2) the Uranus scheme, (3) the Saturn scheme, (4) the Jupiter scheme, (5) the Earth scheme, (6) the Venus scheme and (7) the Vulcan scheme. Each scheme consists of a chain of seven planets and each proceeds on independent lines, there being no intermingling of their activities during their normal course. The first and fifth of this series have each three physical planets, the others one each. The two physical planets of the first scheme besides Neptune are as yet unseen by the telescope. The two of the fifth, in addition to our earth, are Mars and Mercury. The non-physical planets in the schemes are of the matter of the astral and mental planes. Each scheme of evolution is worked out by means of seven Manvantaras or periods of manifestation, each manvantara consisting of seven Rounds, each Round of seven World Periods (following each other on seven planets in succession) and each world period consisting of seven Root Race Periods. Any one of the last covering periods of millions of years. The present humanity on this planet has passed four times around the planets of its chain, and through a fraction over four root race periods. The last planet occupied by us during the present period is the seventh, the present Atlantean, and for the next the Lemurian. The two root races next before the present fifth root race of this planet were the Atlantean and the Lemurian races. The fifth root race has thus for developed as far as fifth subrace and it stated that the beginning of a new subrace, the sixth, may be for to-day in America.

Reincarnation and Karma.—Omitting mention of the interesting career of the reincarnating ego through the primigenius conceptions of the first three rounds of our own planetary chain and even of the first four rounds of this present fourth round, it will suffice to show that among the undeveloped subraces the present fifth root race reincarnation is an experience new for them. The body that once dwelt in the body; that after each death there is a period of more or less duration on the astral plane or followed quickly by another physical incarnation. Later on, as the life experiences grow greater and the reincarnating soul, by his gradual progress, has developed some of the natures of the invisible world, it becomes devachanic, that is to say, a heaven world. Here his experiences are usually long and the contact with the ego in its devachanic state is long and permanent. The ego, when his stay in the invisible world is prolonged or its experiences are usually lasting, for the average man of substantial attainments who has lived a good age, about 15 centuries. Upon the ending of this devachanic life there remains only the reincarnating ego, the lower body constituting the personality having integrated on its respective planes; but principles or qualities animating them having meanwhile left their impress upon the ego. These principles or qualities are called Karma, the ethical law which governs the course of our lives, physical or supernatural, called Karma, and it is ineradicably operative in Reincarnation. It may be defined as the action and result. By virtue of the operation of this law, effects which cannot be attributed to any immediate cause may be traced to existing in other incarnations of the same; thus establishing one's ultimate responsibility for whatever may befall him. Furthermore, owing to this law, one may do at any moment of his present life to the past of his own or of another's that is illusory. or definite effects in the subtler order of things.
resulting in conditions for his next earth life wholly of his own making.

Thoughts build character,
Desires make opportunities,
Actions make environments.

So that whatever one may suffer or enjoy, attain to or fail from is brought about as the result of his own action, in obedience to this law of absolute justice. It is the alternate experience of pleasure and pain which man encounters during his stages of ignorance that develops within him wisdom; and the opportunities guaranteed to him for the accomplishment of this end through Reincarnation and Karma are well nigh limitless. These two doctrines are perhaps the most far-reaching of all the theosophic teaching, as they seem to clear up a host of perplexing questions and establish the basis for a satisfying philosophy.

Propaganda.—Among the results of theosophic propaganda is the restoration to the Western world of the said doctrines of Reincarnation and Karma, and the elimination of the mental incubus of some the teaching of them existing in the East. Another is the occult proof produced of the definite objective reality and potency of thoughts and emotions, showing that these forces are as to their respective planes as visible and real as physical objects are on the physical plane, and that every thought is a living, active entity, persisting for a length of time proportional to the strength that is put into its creation and wields a greater or less influence on those with whom it may come into touch. (See Mr. Leadbeater’s ‘Man Visible and Invisible,’ illustrated, and Mrs. Besant’s ‘Thought Forms,’ illustrated.) Still another is the order which it has brought out of the chaos of the apparently unrelated data of metaphysics, mysticism and the neo-psychology, including the facts of clairvoyance, clairaudience, mesmerism, hypnosis, telepathy, astrology, apparitions, psychometry and the like. And still another is the establishment by irresistible evidence of the basic unity of all the great world religions and their fundamental religious relation to the unprejudiced and open-minded science. To help the religions to clear away their non-essential accretions, to sink into insignificance doctrinal differences, to bring to the fore their points of unity, to study the analogues of moral and spiritual brotherliness and to help each from his own particular standpoint is one of the chief ends to which the theosophist bends his efforts. He does not seek to found a religion, but to expand those we already have, and so give them a deeper meaning and a richer life. While the theosophist limits himself to no particular form of creed, yet the following three truths may be said approximately to include the broad scope of his belief:

1. God exists, and He is good. He is the great lifegiver who dwells within us and without us, is undying and eternally beneficent. He is not heard, nor seen, nor touched, yet is perceived by the man who desires perception.

2. Man and the future are one whose glory and splendor have no limit.

3. A Divine law of absolute justice rules the world, so that each man is in truth his own judge, the dispenser of glory or gloom to himself, the deceiver of his life, his reward, his punishment.

Occultism.—Unless he finds the religion to which he happens to be connected insufficient to meet the demands of his higher nature, the theosophist is apt to seek through the esoteric side of his philosophy the greater light of occultism, in order that he may prepare himself for a more serious religious life. Occultism, as distinguished from the Occult Arts, or Magic, is that system of endeavor which, teaching the methods whereby the personality, or lesser, or more human side of man, may be expanded and expanded his higher or divine nature, leads its votaries along a difficult and narrow pathway of rigid virtue and mental and emotional control, and so requires a firm moral foundation upon which to build the extraordinary powers pertaining to the unseen world. The true Occultist possesses unselfishness, justice and true knowledge; he has compassion and wisdom; his desire nature is purified and his habit of mental concentration fixed; the contents of his consciousness are something more than his five-sense perceptions plus the deductions he draws from them by his reason, and such vague ideas and intuitions as he may possess.*

Through Occultism the aspirant, wearying of the phenomenal world, seeks to outstrip his fellows in evolution and within a few strenuous incarnations to accomplish what the mass of humanity in the normal course will only attain to in long reaches of time, namely, the highest adeptship or liberation from the wheel of rebirth. In doing so he treads a path which, according to occult teaching, has three great divisions:

1. The probationary period, before any definite pledges are taken or initiations (in the full sense of the word) are given. This carries a man to the level necessary to pass successfully through what in theosophical books is usually called the critical period of the fifth round.

2. The period of pledged discipleship, or the path proper, whose four stages are often spoken of in Oriental books as the four paths of holiness. At the end of this the pupil obtains adeptship—the level which humanity should reach at the close of the seventh round.

3. What may be called the official period, in which the adept takes a definite part (under the great Cosmic Law) in the government of the world, and holds special office connected therewith, but none of the details of this period can be made known.

The probationary path has five stages but the division between its stages is less distinctly marked than those of the higher groups, and perfection is not required in anything during this period, only a serious effort toward it. In the first stage the candidate for adeptship acquires a firm intellectual conviction of the impermanence of mere earthly aims; in the second a perfect indifference to the fruits of his own action; in the third (a) perfect control of mind, (b) of conduct, (c) a generous toleration, (d) endurance, (e) one-pointedness, (f) confidence in his Master and himself; in the fourth an intense desire to work with the Master; and in the fifth he gathers up and strengthens his previous acquisitions for the next great step, which will set his feet upon the path proper as an accepted pupil. During his life on the probationary path the pupil will have received much teaching from his Master, usually imparted
during the sleep of his physical body, while he himself is clad in his astral body in full consciousness on the astral plane. He will also have been taught while thus functioning in the astral world to bring help and comfort to the inhabitants of that world, who having laid aside their physical bodies at the gateway of death have passed beyond the physical plane. This phase of occult work is sometimes called that of the Invisible Helpers and is performed, be it understood, by men still having physical bodies and who have developed this power of functioning consciously outside the same on inner planes. The pupil will further have been trained in meditation, and this effective practice both in waking consciousness and outside the physical body during its sleep will have quickened and brought into active exercise many of the higher powers.

When the pupil has developed the fifth qualification of the initiation path he is ready for initiation upon the part proper, henceforth to serve his Master, whom he now meets face to face, in helping forward the evolution of the race, his life, "to be offered up on the altar of human evolution," is called for, to be used for the common good. This path consists of four distinct stages and the entrance to each is guarded by an initiation. The second initiation can be passed the pupil must lose the illusion of personal self is a reality, and must feel himself one with all; he must destroy doubt and superstition by knowledge; ere he passes the third he must bring into full working order the inner faculties, those belonging to the sublimer bodies; now he needs to incarnate but once again; ere the fourth is passed he must dispense with all desire and aversion and see the One Self in all. At this stage he needs to return no more. The fourth initiation admits him to the last stage of the path where he throws off all clinging to life in form and all longing for even formless life. Then he casts off the "I-making" faculty—pride, irritability and ignorance, and henceforth dwells on the plane of unity. The man is then perfect, a free, the liberated one. He has won Nirvana. "He has completed man's ascent, he touches the limit of humanity; above him there stretches hosts of Mighty Beings, but they are superhuman; the crucifixion in flesh is over, the hour of deliverance has struck and the triumphant 'It is Finished' rings from the conqueror's lips, he has vanished into light nirvanic. But being now Master of Compassion as well as Master of Wisdom, he returns from that light to earth, henceforth to devote himself to the service of humanity with mightier forces at his command than he wielded while he trod the path of discipline, binding all his sublime powers to the quickening of the evolution of the world. Such an one was the Buddha—such tireless worker that Souls who tread the earth today, seduced from its external strife, yet pouring down upon mankind from the great heights of their sublime advancement—may findest blessings guidance by means of their divine powers whole races and nations, but unknown to all but the few earnest souls who open their minds through the ancient gateway of Occultism, the portal of which has throughout the cycle of time shall close and all manifestation cease, the greater portion of man-kind will have reached this high stage growth. And then shall all be gathered to Him for the cosmic rest only after aeons of time, to emerge again with Him to be the architects and builders of the new universes. Such are a few of the teachings of the Ancient Wisdom, given forth as Thesosophy and Occultism.

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The materials for the above sketch have been drawn more or less literally from the above-mentioned works.

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THEOTOKOS, a title given to the Virgin Mary by a decree of the Third Ecumenical Council, which met at Ephesus 431 to condemn Nestorian heresy. The term means 'mother of God' and is intended for
applied in the annunciation of the angel to
"that holy thing which shall be born
e shall be called the son of God." Theo-
(Latin, Deipara) implies that the child
ry was of divine nature from the moment
conception; that he was not born mere
whom, as Nestorius taught, the divine
was subsequently imparted.

THERA, thá-ra or thér-a, an island in the
1 Sea, belonging to the Grecian Archi-
that most southerly of the Cyclades. It
volcanic formation and presents many in-
ning phases. New islands are formed from
time, by its volcanic action, notably the
1866. Scientists have given the island
erable attention and many observations
seen made and records kept. The soil is
ertile.

THERAMENES, thér-am'-é-nez, Athenian
ian of the 5th century B.C. He first be-
prominent in 411 as a member of the
if of 406, but perceiving the inevitable
of that government he joined the
party and assisted in its overthrow.
B.C. he was in command of a portion of
henian fleet, with which he cruised about
acted tribute from the neighboring is-
and later he joined the fleet under
bulus, with whom he took part in the
of Cyzicus. He subsequently served with
ues, participated in the siege of Chal-
406 B.C. and in the capture of By-
. After the battle of Arginusae, in 406,
aired to Athens, and in order to exculpate
for not saving the crews of the ships
d his colleagues of neglect, and through
stimony they were sentenced to death.
B.C., when Athens was besieged by the
n general Lysander, Theramenes was
an envoy to negotiate terms with Sparta.
proselytly remained on his mission for
months, during which time Athens was
d to dire extremity and was forced to
peace upon such terms as to place her at
ercy of the Lacedaemonians. He was
one of the Thirty Tyrants (q.v.) after
ce, and at first heartily supported the
es of the government. The violent
res of Cassandria and his colleagues, how-
duced him to form an opposing party,
aptly increased in strength. He was
d by Critias of being a public enemy,
d to prison and forced to drink the
k.

THERAPEUTICS, that branch of medicine
deals with the treatment of disease.
ies; physicians treat. This is an old
as true to-day as it was when uttered
000 years ago by a famous Greek phys-
icians. They have noted that power of the
body the vis medicatrix nature
of which nature tends to right her own
eded organs, and it is important to recog-
is all-important function of the body, and
fer to overzealousness in the use
ents with the natural powers of self-restoration. An innu-
alf-hearted therapy, however, is not
ical system, even if such reconstructive
of nature are granted. The modern
ion of disease does not admit of ready
ication. In the articles on disease and
vy (q.v.) it is attempted to define what
is meant by disease, but such definitions are far
from being satisfactory because of the im-
mense variety of diseased conditions, their
omand causation and their devious progres-
sions. In all disease certain groups of physio-
ological functions are altered, and in the at-
tempt to aid nature to bring these disturbed
physiological activities to a normal condition
the chief work of the therapist lies. It
akes little or no difference what the agencies
ay be that are used — certain, as has been said,
one are not necessary — yet the ideal of the ther-
peutic art is to restore to normal condition, as
ar and as quickly as possible, the disturbed
odily functions. While it is true that the
ician of to-day employs many of the agents
used by physicians thousands of years ago,
ere is a far greater precision and a much
more comprehensive series of ideas concerned
in their use by the well-equipped modern thera-
peutist than was possible to his early predeces-
sors. The one aim of the physician throughout
the centuries has been the alleviation of suffer-
and the restoration of the diseased to health
or to comfort; and notwithstanding the many
small cliques and divergences of opinion, the
progress toward scientific therapeutics has been
steadily and increasingly satisfactory. At the
out of this summary of therapeutics it may
be well to consider for a moment the different
classes of agents at hand by the use of which,
singly or combined, the physiological functions
of the body may be modified, and thus be made
useful in the healing art.

Expressed categorically, the different ther-
peutic agents or systems are: (1) Sugges-
therapy; (2) Dietotherapy; (3) Physico-
therapy; (4) Mechanotherapy; (5) Phama-
otherapy; (6) Surgotherapy. Each of these will
be briefly discussed.

Unquestionably the oldest and yet strongest
therapeutic agent is suggestion. The power to
heal by faith is not the special property of any
sect or class, nor the exclusive right of any sys-
tem. Belief in gods and goddesses, prayer to
ids of wood, of stone, of gossamer fiction,
faith in the doctor, belief in ourselves engen-
dered from within or from without — these are
all expressions of the great therapeutic value
for healing that resides in the influence of
mental states on bodily functions. These will
not move mountains; they cannot cure consump-
tion; they do not influence a broken leg, nor an
organic paralysis; but suggestion, in its various
forms, may be and is one of the strongest aids
to all therapeutic measures. Of its abuse by
designing hypnotists, blackmailers, clairvoyants
and a motley crew of parasites, space does not
permit particularization. The human mind is
credulous — it believes what it wants or wills to
believe; and the use of suggestion in thera-
petics is one of great power for good and for
evil.

The treatment of disease by diet constitutes
another large branch of the therapeutic art.
Modern chemistry has resolved all foods and
drinks into their elements, and has given the
physician valuable aids in the treatment of a
large number of diseases. Many obscure dis-
orders, such as diabetes, gout, myxedema, obe-
ity, etc., are closely allied with certain defects in
the metabolism of certain physiological systems
of the body. Many of these are best treated by
a dietary regimen, combined, it may be, with other means. Many of the minor disorders of the digestive tract (see Digestion) are best treated by regulation of the diet.

By physiotherapy is meant the use of certain physical agents such as heat, cold, light, electricity, etc. Certain forms of application of the agents are termed (a) hydrotherapy (q.v.), in which heat and cold are applied by means of water; (b) phthotherapy (q.v.), in which light is incident in the treatment of disease; Sunlight, electric light, ultra-violet rays (Finsen's light), X-rays, radio-active substances—these all exert on the tissues of the body certain influences that, properly applied, may bring about restoration of disordered functions, and thus aid nature in curing disease.

Mechanotherapy is the use of mechanical movements in treatment. Massage, vibration, gymnastics, Swedish movements, etc., are some of the different forms in use. Under the name of osteopathy (q.v.) it is attempted to elevate one of the oldest aids to treatment, in use by the Greeks, Chinese, etc., to the rank of an exclusive system.

Under the terms pharmacotherapy and surgico-
therapy are included the treatment of disease by drugs, so-called, and by surgical means. So far as treatment by means of drugs is concerned, it is interesting to note that practically all drugs act on the tissues of the body in some chemical or physicochemical manner. They may have a certain selective action on certain tissues of the body. Thus the large group of the alcohols, comprising ethers, aldehydes, chloroform, hypnotics—such as trional, sulphonial, veronal, urethane and a large number of others—have a selective action on the nervous tissues of the brain, blemishing their activities and causing drunkenness or anaesthesia or sleep, according to the dose or other conditions. Others act on sensory nerves, diminishing pain; such are cocaine, opium, antipyrin, acetaminol, phenacetin, camphor, etc. Again, other remedies are chiefly on the intestines, giving the large group of cathartics, and so the entire list of drugs might be analyzed. Given a knowledge of the selective or generalized action of the drugs, the use that they may exert in combating various physiological activities is but a matter of application and in accordance with the correct interpretation of the cause of the disturbed functions will the therapeutic application be of direct value or not. In other words, drugs are nothing more than chemical agents which may be used to modify certain physiological activities; if by their well-known power in modifying these activities other morbid activities may be corrected, they are agents for good. For a consideration of surgicotherapy, see Surgery.

One other phase of therapeutics remains to be considered. It has been pointed out that nature has resources of her own for overcoming certain types of disease. Can these natural powers be so played upon or affected as to increase their operation? Along this line new paths have been opened up since the recognition of a large class of diseases known as infectious. Bacteriology (q.v.) has taught that disease organisms (bacteria) cause the disturbance (disease) in the body, not so much by their physical presence as by the extremely virulent poisons that they form. It is the same with the human body to get rid both of bacterial poisons that makes the disturbance called the disease. Thus the typhoid is one of nature's efforts to put death-blow to the pneumococcus, the organism that causes the disease. Such a temperature in malaria (q.v.) as kills off a great many of the parasites of blood.

But in addition to these larger and palpable efforts on the part of nature to come the invader, a series of subtle, effective defenses are at work in the body. Some of the elements of which are thus in some diseases there is evidence of a blood-serum a direct chemical antagonist, to the poisons of the invader. Such a protective power is diphtheria (q.v.). (See Antitoxin.) In addition, the discovery of which was a result of an accident, is a form of serum. (See Serum Therapy.)

The reasons why immunization is considered a modified smallpox of the cow are not yet as the true cause of smallpox is not indubitably proven, but the time is not far off when different factors herein involved will be earthed. A large number of other questions concerned in this great question of acquired immunity (q.v.)

Human progress has been likened to the ups and downs and side-lurchward steps in the path of therapy as been many; but withal there has been are a blaze of progress. That which has been found to be true has been has become the heritage of the world. The physician class has been the people at large in the general use, there have been many side-tracks or broad road of therapeutics; innumerable have had their little day or their 100 each in its turn has contributed to the equilibrium of the


SMITH ELY JELF
Editor of 'Journal of Nervous and Mental Disease.'

THERAPIA, a health resort porus, nine miles north-northeast of Canopus, of which city it is a ancient Pho.
Medea spread her drugs. One of the patriarchs of Constantinople changed to Therapia ("cure"). It marks a string between what is locally called the Bosphorus and the Lower Bosphorus. The summer residences of European lords, Turkish officials and wealthy.

**RESA, Saint.** See TRESA, SAINT.

**RESIOPEL, tér-á-zé-ó-péll, or MA-ERESIOPEL, má-řeá-tér-á-zé-ó-péll Szabadka.** Hungary, a royal free town on the Bacs-Bodrog, 25 miles south of Szegedin, in a broad plain between the Theiss and the Theiss. The buildings worthy of note are the churches of Saint Theresa, if the Franciscans, a beautiful Greek town-house, etc., theatre, barracks, and music-school. The industrial clades tanneries, linen and leather manufакture, and dye works. Wheat, tobacco, wines are grown and cattle-raising is important.

There is a brisk trade in horses, cattle, hogs, hides and wool. There is a useful watering-place in the vicinity. Pop. 20.

**RIAC, or THERIACA,** a compound have been first prepared by Andromachus of Crete, who was physician to Nero. It was supposed to be an antitoxin, and continued in use throughout the life of the Emperor. As prepared in Venice and shown to the emperor it was a compound of 64 drugs, and reduced by means of honey to the size of a drachm (q.v.), large extinct carnivorous with shortened coracoid and double-tusked.

**RMÉ, thérmé (from the Greek signifying originally warm or hot properly warm baths, but also applied to the baths of the ancients. During an Empire the buildings for this purpose were large and the baths were kept at suitable temperatures.) The baths of Nero, ara della and Dioecetian at Rome were the most magnificent and luxurious in the world.

**RMA SPRINGS.** See SPRING.

**RMIC FEVER.** See SUNSTROKE.

**RMIDOR, thérm-i-dôar. (Fr. tém-mé, 11th month of the year in the calendar of the first French republic. It contrived with other chemical amalgamations to form a compound of the by alcoholic fermentation, or when a body or system (such as a solution) undergoes certain kinds of physical change. Its precise limits are not easy to define, since the subject merges into ordinary chemistry on the one hand and into thermodynamics on the other. Any chemical operation can be considered from two points of view, according to the importance of the modification that it produces in the nature of the substances that are involved or in the quantity of energy which is absorbed, liberated or otherwise transformed at the same time. It is the province of thermochimistry to investigate the transformations of energy that occur in such cases. The complete discussion of the energy-transformations that accompany a given chemical change should include the consideration of every type or form of energy which may be present: but the investigations which have hitherto been made have related chiefly to the quantities of heat which are liberated or absorbed, and it is to this circumstance that the term now owes its present name, "thermo-chemistry.""

When these are ignited in a properly prepared crucible violent reaction takes place, the oxygen of the oxide being taken up by the aluminums, leaving a very pure metal, nickel, cobalt, etc. This process is now much used to get metals from those oxides that hitherto have resisted all ordinary methods of reduction. When ordinary permutant is ignited the temperature produced is so high that the iron and the slag are left in a molten and highly-heated condition. If this iron is allowed to flow on to another piece of iron or steel it will heat it enough to soften it and the whole will harden to a homogeneous mass. In this way it can be used to replace broken parts of machinery, to mend broken or cracked propeller shafts, to weld together railroad rails so as to form one continuous rail, etc. Some of the important features in this process are its cheapness, ease of execution and the fact that machinery, etc., can be repaired in position. The method is to surround the part to be repaired with an ordinary mold box; a magnesium-based crucible with a plug in the bottom is placed over the opening; the thermit is placed in the crucible, ignited and as soon as the violent reaction has subsided the plug is pulled and the white hot metal allowed to flow into the mold. Iron tubes can be welded together by placing the ends in a mold and allowing the thermit product to flow in such a way that the liquid slag first comes in contact with the tubes. The slag forms a protective layer and prevents the hot iron from uniting with them, though it does allow the tube ends to become hot enough to unite as one piece. Railway rails can be joined where they lie on the track, and large pieces of broken machinery in mines or on shipboard can be readily repaired without removal.

**THERMO BAROMETER.** See THERMOMETER.

**THERMO-CHEMISTRY, or THERMAL CHEMISTRY,** that branch of physical chemistry which deals with the chemical changes which occur when chemical reactions take place or when a body or system (such as a solution) undergoes certain kinds of physical change. Its precise limits are not easy to define, since the subject merges into ordinary chemistry on the one hand and into thermodynamics on the other. Any chemical operation can be considered from two points of view, according to the importance of the modification that it produces in the nature of the substances that are involved or in the quantity of energy which is absorbed, liberated or otherwise transformed at the same time. It is the province of thermochimistry to investigate the transformations of energy that occur in such cases. The complete discussion of the energy-transformations that accompany a given chemical change should include the consideration of every type or form of energy which may be present: but the investigations which have hitherto been made have related chiefly to the quantities of heat which are liberated or absorbed, and it is to this circumstance that the term now owes its present name, "thermo-chemistry."

The quantity of heat that is liberated or absorbed during a proposed chemical reaction can be determined by causing the given reaction to take place in the interior of a calorimeter. The
particular form of calorimeter that is to be used will naturally depend to a considerable extent upon the nature of the reaction that is to be studied. If the problem consists in the determination of the quantity of heat that is liberated when two given liquids are mixed, the calorimeter commonly consists of a platinum vessel, capable of containing from 500 to 1,000 cubic centimeters, placed inside of another vessel of silver; the space between the two vessels being filled with water. The liquids that are to be mixed are usually introduced into the vessel at the same temperature as nearly as possible, and are then mixed in the platinum vessel. The rise of temperature of the calorimeter being noted, and the masses and specific heats of the various parts of the calorimeter (and its contents) being determined by separate experiments, we are then in position to calculate the quantity of heat energy liberated by the reaction. For detailed information with regard to the various kinds of calorimeters that are used, and for a discussion of the errors to which such instruments are liable, reference must be made to extended works upon heat and thermo-chemistry. (See the references at the end of this article).

In thermo-chemical work, the unit of mass is almost invariably the gram; and the gram is specifically mentioned. The unit of heat is also understood to be the calorie, which, for thermo-chemical purposes, is defined as the quantity of heat required to raise the temperature of one gram of water by one Centigrade degree, when the temperature of the water is in the vicinity of 18° or 20° C. The notation that is employed in expressing the results of a thermo-chemical experiment upon the heat that is developed by a given chemical reaction is simple. The formula of the substances that react are written within square brackets, and separated by a comma or a colon; it being understood that the number of grams that are present of any one substance is equal to the molecular weight of that substance. A sign of equality is written after the bracketed formula, and on the right hand side of this sign the number of calories of heat generated or absorbed by the reaction is written; a positive sign being prefixed (or omitted) when heat is evolved, and a negative sign when it is absorbed. The indices that are attached to the symbols of the various elements are written above those symbols, instead of below. For example,

\[ \text{H}_2\text{O} \quad \text{or} \quad \text{H}_2\text{O} \quad \text{or} \quad \text{H}_2\text{O} \]

signifies that when two grams of hydrogen and 16 grams of oxygen, both at about 18° C and under atmospheric pressure, combine to produce 18 grams of water (also at 18° C), the quantity of heat that is evolved is sufficient to raise the temperature of 2 grams of water by one Centigrade degree; the temperature of the water being about 18° C.

When a compound is broken up into its constituent parts, the bracketed formula are preceded by a negative sign. Thus the expression

\[ \text{H}_2\text{O} \quad \text{or} \quad \text{H}_2\text{O} \quad \text{or} \quad \text{H}_2\text{O} \]

signifies that when, by any means, 36.5 grams of hydrochloric acid are decomposed so as to set free 1 gram of hydrogen and 35.5 grams of chlorine, the change is accompanied by the sorption of a quantity of heat that is sufficient to raise the temperature of 1 gram of water by 1° C.

The heat of formation of a substance is formed from its constituents, as is taken as negative when the formation of substance is accompanied by the absorption of heat. In general, any given substance prepared in various ways, from different or constituent substances, the same case of formation will be different, according to the particular substances that are regarded as constituents. For example, sulphuric acid is prepared from sulphur, oxygen and according to the equation

\[ \text{S} + \underbrace{\text{O}}_{3 \text{O}} + \underbrace{\text{H}_2\text{O}}_{3 \text{H}_2\text{O}} = \underbrace{\text{H}_2\text{SO}_4} \]

or from sulphur dioxide, oxygen and according to the formula

\[ \text{SO}_2 + \text{O} + \underbrace{\text{H}_2\text{O}}_{3 \text{H}_2\text{O}} = \underbrace{\text{H}_2\text{SO}_4} \]

or from sulphur trioxide and water; according to the equation

\[ \text{SO}_3 + \text{H}_2\text{O} = \underbrace{\text{H}_2\text{SO}_4} \]

and the heat of formation will be different in these several cases, if we regard the materials from which the acid is formed as the constituents of the acid. But if prepared from the elements sulphur, oxygen and oxygen (all three being in certain standard initial physical states instance), then the heat of formation is the same, whether these elements completely form the acid, or whether the heat of sulphur and hydrogen are first prepared and these subsequently combine to form acid. In fact, the principle of the conservation of energy shows that when a system of bodies passes through a succession of changes, either physical or chemical in nature, so as to pass from one given initial condition to another given final state, the total change that the system undergoes in its internal energy of the body or system is exactly the same, whatever the nature of the transformation may be, by which the change is effected. Hence it follows that the heat that is emitted or absorbed represents a measure of the decrease or increase in the internal energy of the system, the total quantity of heat emitted or absorbed will be independent of the way in which the transformation takes place. If, however, the system forms external mechanical work in from its initial state to its final state, energy that is actually given off will be less than that corresponding to the change in internal energy by the amount expended in performing the external work. Many of the reactions that are considered under thermo-chemistry, the external work performed is too small to be of any significance, and in these cases the change in internal energy is regarded as independent of the kind of information that the transition involves. Some cases, however, and particularly those systems under consideration are wholly exogenous, the external work that is formed is great enough to require...
THERMO-DYNAMIC ENGINE—THERMODYNAMICS

Thermodynamics, or the mechanical theory of heat, that branch of physical science which treats of the relation of heat energy to energy of other kinds, and particularly of the convertibility of heat energy into mechanical energy, and the converse. In order to discuss, qua the conversion of one kind of energy into another kind, we must first have a definite method of measuring each of them. Mechanical energy (see ENERGETICS) is measured by determining the amount of work that a given quantity of it can perform; the customary unit employed for this purpose being the "foot pound" or the "metre-kilogram" in engineering practice and the "erg" in scientific work; the "erg" being defined as the quantity of work done in overcoming a resistance of one dyne through a distance of one centimetre. The unit employed in the measurement of heat is almost universally the quantity of heat required to raise the temperature of some definite mass of water through one degree, on some stated part of the thermometric scale. The ordinary "British thermal unit," which is used in engineering practice in English-speaking countries, is the quantity of heat required to raise the temperature of one pound of water by one Fahrenheit degree; and in countries that use the metric system, the engineering unit is the quantity of heat required to raise the temperature of one kilogram of water through one centigrade degree. As the specific heat (q.v.) of water varies slightly at different temperatures, these definitions are not absolutely definite, unless the part of the thermometric scale at which the experiment is to be performed is specified. Unfortunately there is no general agreement among engineers on this point; and for most purposes in practical engineering it is customary to ignore the slight variation in the specific heat of water and to consider the foregoing definitions to be sufficiently precise as they stand. For scientific purposes, where the greatest possible accuracy is required, this course is not permissible, and it becomes necessary to specify the particular degree through which the temperature of the water is to be raised. Even here there is no definitely established convention; but there appears to be a growing tendency to adopt the degree that extends from 14.5° C. to 15.5° C. In scientific work, too, it is customary to define the thermal unit in terms of a gram of water, instead of a kilogram; and the scientific heat unit (which is called the "small calorie," to distinguish it from the "greater calorie" that is used in engineering) may be defined as the quantity of heat required to raise the temperature of one gram of water from 14.5° C. to 15.5° C.—0.01° C. being the temperature at which water has its maximum density—is also known as the "therm." The science of thermodynamics is founded upon two general, fundamental laws, which, so far as we are aware, are absolutely rigorous and which are respectively known as the "first"
and "second" laws. These we shall consider in order.

The "first law of thermodynamics" is nothing but a special application of the general principle of the conservation of energy. (See ENERGETICS.) It states that whenever heat energy is converted into mechanical energy (or the reverse), then for each unit of one kind of energy that disappears there is always a perfectly definite and constant quantity of energy of the other kind which appears. Mayer and Joule, independently, arrived at this law in the year 1840. There has been in the past some considerable controversy as to the credit that should be assigned to these respective investigators. We cannot enter into this discussion, but the reader who desires to follow it up will find an admirable and very fair statement of the facts of the case in two papers on the Copley medals of 1870 and 1871, in Tyndall's "Fragments of Science." Joule did a vast amount of experimental work for the purpose of confirming the first law of mechanical equivalent of heat, as the constant is called, which expresses the number of units of mechanical energy that are equivalent to one unit of heat; and in the course of his labors he tried the different experimental methods (Consult 'The Scientific Papers of James Prescott Joule'). His best known method consisted in stirring a known mass of water and measuring the rise in temperature so produced as well as the quantity of mechanical energy expended in the stirring. He concluded that the temperature of one pound of water is raised by one Fahrenheit degree by the expenditure of 772 foot-pounds of mechanical energy. This constant, which is known as "Joule's equivalent" and is denoted by the symbol J, has played an all-important part in engineering and scientific work for more than half a century. A better value of it was obtained by Rowland in 1879 (consult 'The Physical Papers of Henry Augustus Rowland'); but the prestige of Joule was so great that the superiority of Rowland's work was not generally recognized for many years. Rowland's method was similar to that of Joule, but he worked with far better apparatus, and the result is generally given as 0.001785 B.S. foot-pounds. It had been made since Joule's work was done, both in calorimetry and in thermometry. It was in the course of this work that Rowland made the discovery that when temperature is defined in accordance with the scale of the normal constant-volume air thermometer, the specific heat of water has a minimum value at a little above 30°C,—a discovery which implies a high degree of precision in the experimental methods employed, and which has been abundantly verified by later investigators. Rowland's value of the mechanical equivalent of heat may be stated as follows: Taking as the unit of heat the quantity of heat required to raise the temperature of one kilogram of water from 14.5°C to 15.5°C, the mechanical equivalent is 427.4 kilogram-metres at sea-level in the latitude of Baltimore. If the unit of heat is the quantity of heat required to raise the temperature of one gram of water from 14.5°C to 15.5°C, then the mechanical equivalent is 41,890,000 ergs. Numerous other experiments have made determinations of the mechanical equivalent, both by the method followed by Joule and Rowland, and by other methods. Prominent among these are Griffiths, who heated the water in his calorimeter mainly by means of a known resistance, and hence giving out a known quantity of heat. Taking as a unit of heat the quantity of heat required to raise the temperature of a kilogram of water from 14.5°C to 15.5°C, it is found that the mechanical equivalent is 427.45 kilogram-metres at sea-level in the latitude of Greenwich. Rowland's value, when expressed in these same units and corrected to the latitude of Greenwich, is 427.0. For further details concerning the experimental determination of the mechanical equivalent consult Preston, 'Theory of Heat'; and for numerous interesting illustrations of the first law of thermodynamics, consult Tyndall, 'Heat a Mode of Motion.'

The second law of thermodynamics is hard to explain in a limited space, or without the use of higher mathematics; and, as Rankine remarked, its exposition has been much neglected by the writers of popular works, so that "inexplicable" and "impossible" are terms that are often used to describe what actually happens, or what really must happen to satisfy the second law of thermodynamics. It is unique in its form, the second law merely states that heat always tends to pass from a hotter body to a colder one. This fact is obvious enough in simpler manifestations; for every housewife knows that to make the kettle boil she must put it on the stove and not in the refrigerator. It is not so evident, however, that there are no conditions whatever under which heat will pass of its own natural tendency from a lower temperature to a higher one. It is not evident on first thought, for example, that we cannot make a burning glass big enough to give a temperature at its focus, which shall be higher than the temperature of the sun; yet we cannot do so, if the advances that have been made since Joule's work were done, both in calorimetry and in thermometry. It was in the course of this work that Rowland made the discovery that when temperature is defined in accordance with the scale of the normal constant-volume air thermometer, the specific heat of water has a minimum value at a little above 30°C,—a discovery which implies a high degree of precision in the experimental methods employed, and which has been abundantly verified by later investigators. Rowland's value of the mechanical equivalent of heat may be stated as follows: Taking as the unit of heat the quantity of heat required to raise the temperature of one kilogram of water from 14.5°C to 15.5°C, the mechanical equivalent is 427.4 kilogram-metres at sea-level in the latitude of Baltimore. If the unit of heat is the quantity of heat required to raise the temperature of one gram of water from 14.5°C to 15.5°C, then the mechanical equivalent is 41,890,000 ergs.
higher temperature to a lower one, in the same way as we think of water tending down hill. Water will not run up its own accord, but it may be forced to run down a lower level to a higher one by the force of energy upon a pump or other device. The correctness of Clausius’ sism with regard to heat is substantiated by the fact that no case has yet been discovered where it is demonstrably violated. On the other hand, many previously unknown phenomena in every instance subsequent experiment has confirmed the prediction in every respect. A short account of some of the better objections that have been urged against the second law, consult the portion of Brown’s translation of Clau-
 Mechanical Theory of Heat, studying the transformation of heat into mechanical energy (or the reverse) is customary to think of the con-
 as being performed by a suitable type of engine; for this conception helps to make the problem definite, so that the mind can grasp the principles involved. The heat engine is usually conceived to be in construction, so as to run without and without loss by radiation or convection. In fact, the materials of which it is composed is assumed to be incapable of absorbing any heat at all. Some of its parts, however, be transparent to heat, and others to olutely opaque to it; and we may be convinced, by the discussion of the effects, whatever those may be. These remarks are usually assumed, further, to be perfectly reversible, so that when the expenditure of mechanical power, they are used backwards, all of the normal effects of the engine take place precisely as they are reversed in a contrary sense. If, for example, the engine, at some instant in its formation, absorbs a quantity of heat from outside body whose temperature was lower than when the engine reaches the corrected state in its reversed motion, it must at this same quantity, Q, of heat, and give it out again to the same body from it originally abstracted it, and at the temperature, T. An engine which fulfills these various conditions is called a tly reversible engine; or, more briefly, an ideal engine. Carnot’s Theorem.—In 1824 Carnot gave a theorem (consult his Reflections on the Motive Power of Heat, Thurstons’s projection), which may be stated in the following form: Of all the possible kinds of engine, which run by converting heat into mechanical energy, and which take the same amount of heat at one temperature and reject all the heat they do give out (if any) at any other temperature, there is none that is more efficient than the ideal, reversible engine; efficiency being defined as the fraction of the available working energy that is converted into actual work. This theorem is of exceeding importance, as it holds true not only for the untold thousands of kinds of ideal engines that we might be able to think of at the present time, but also for any others that may depend upon principles of nature as yet undiscovered; always supposing that the two fundamental laws of thermodynamics, as stated above, are true. In Carnot’s time, heat was believed to be a substance; and Carnot’s proof of his theorem is based upon this view. After the newer conception of heat had been attained, however, it became possible to show by equally sound demonstration in accordance with the two thermodynamic laws now admitted. The proof is as follows: Let us assume that the theorem is false, and that there is some other engine, which we will designate as B, which is more efficient than some particular ideal reversible engine, A, which runs between the same two temperature limits. Let T1 be the temperature at which both engines take their heat, and let T2 be the temperature at which each rejects such heat. If A does not transform into work. Let H1 and H2, respectively, be the quantities of heat taken in and rejected, during a given time, by the reversible engine, A, and let H’1 and H’2 be the quantities taken in and rejected, respectively, by another engine B. The quantities of heat that are transformed into work by A and B, respectively, are then (H1 - H2) and (H’1 - H’2); and the efficiencies are respectively (H1 - H2)/H1 and (H’1 - H’2)/H’1. The condition that we are assuming, in violation of the theorem, is that the efficiency of the engine B is greater than that of A; that is, (H’1 - H’2)/H’1 > (H1 - H2)/H1; or, what is the same thing, H1(H’1 - H’2) > H’1(H1 - H2). Now suppose that the two engines are coupled together so that the engine B runs forward and drives the reversible engine, A, backward. Then A, owing to its reversibility, for every (H1 - H2) units of work that it absorbs, takes in H2 units of heat at the temperature T2, and rejects H1 units of heat at the higher temperature, T1; while the other engine, B, for every (H’1 - H’2) units of mechanical work that it performs, takes in H’1 units of heat at the higher temperature T1, and rejects H’2 at the lower temperature T2. Now in the case supposed, where one of the engines drives the other, the mechanical energy developed by the engine B is entirely absorbed by the reversed engine, A. Hence we have (H’1 - H’2) = (H1 - H2); and this equation, taken in connection with the foregoing inequality, gives H1 > H’1. That is, the heat delivered by the doubled engine to the source whose temperature is T2, is greater than the heat that is being withdrawn from that source; so that if we regard the doubled engine as a single machine, we have a case in which heat is passing, by its own natural tendency and without external compulsion, from a temperature T2 to a higher temperature, T1. But this is contrary to the second law of thermodynamics; and hence it follows that it must be that no such engine as B exists. In other words, there is no engine which takes its heat all at a temperature T1, and rejects what it does reject at a lower temperature T2, which has a higher efficiency than the ideal reversible engine running between these same
.temperature limits. It will be observed that in case both of the engines are reversible, the foregoing proof can easily be made to show that neither one is more efficient than the other one. It follows, therefore, that all ideal reversible engines which take in no heat except at \( T_h \) and reject none except at \( T_c \) have the same identical efficiency; and this efficiency can, therefore, depend upon nothing but the two temperaturas \( T_h \) and \( T_c \) and the state of the heat absorbed and rejected by an ideal reversible engine in which the arrow is reversed by the expansion of air indicated that the numerical values of the function \( F(T) \) can be expressed in the form \( F(T) = \frac{C}{T} + C + x \), when \( T \) is the temperature according to the normal, constant, and absolute scale (see Thermometry); \( C \) being a constant and \( x \) a small variable term, whose value between the freezing and boiling points of water, never exceeds a very small fraction of a degree. For the details of the method by which the numerical values of the function \( F(T) \) are evaluated, reference must be made to special works on thermodynamics, and to papers on the subject of absolute temperature. (See Heat.)

It is sufficient, here, to say that by the application of the two fundamental principles of thermodynamics to the phenomena that occur when a mass of gas changes its state by an infinitesimal amount, it is possible to deduce a differential equation which, when integrated for the conditions that prevail in a constant-volume thermometer filled with the kind of gas under consideration, will give a finite relation between the scale of the gas thermometer and the absolute scale. One of the most important terms in this differential equation relates to the change of internal energy experienced by a gas when the volume of the gas changes while the temperature remains constant. In order to evaluate this term, special experiments are necessary, in which the gas is caused to change its volume while the temperature is constant. Joule and Kelvin were the first to devise an experiment capable of yielding accurate results of this character, and the work that they did along these lines more than half a century ago has never yet been adequately verified, although it constitutes the only secure basis of all that we know, to day, about the numerical corrections that must be applied to the readings of a gas thermometer. One of the most important terms in this differential equation relates to the change of volume of a gas when the temperature is measured by the normal constant-volume hydrogen or nitrogen thermometer, in

depend, evidently, upon the kind of thermometer that is used in defining the temperature \( T \); but whatever the form of the function may be, its numerical value will always be the same for any fixed temperature \( T \); provided the nature of the thermometric scale may be, from which it is obtained. This follows from the fact that the last equation above must always hold true, and \( H_1 \) and \( H_2 \) are not dependent in any way upon the language of mathematics, the efficiency of an ideal reversible engine which runs as here described is a "function" of the temperatures at which heat is absorbed and rejected, and of nothing else.

In the foregoing demonstration it was assumed that all of the heat taken in by the entire engine \( B \) was either transformed into mechanical energy or rejected at the temperature \( T_b \). If the engine \( B \) is of such a kind that this condition is not fulfilled, by reason of the engine losing some of its heat at temperatures intermediate to \( T_t \) and \( T_b \) (or by reason of any other imperfect in design or construction), then the theorem is still true; for the assumption that we have made above is the one that is least favorable to our demonstration. Absolute Temperature. Let us consider an ideal, reversible engine, which in each unit of time takes in \( H_t \) units of heat at the temperature \( T_t \) and rejects \( H_r \) units of heat at the temperature \( T_r \). Then the efficiency of the engine is \( (H_r - H_t)/H_t \); and this (as we have seen) must be equal to some function of \( T_t \) and \( T_r \). It will be more convenient, however, to write the efficiency in the form \( 1 - (H_r/H_t) \); which is obviously permissible. Since this is a function of the two temperatures, so also is \( H_r/H_t \); and we may write \( H_r/H_t = f(T_t, T_r) \). Now \( H_r \), being the heat rejected by the given engine at the temperature \( T_r \), may be used again in a second ideal reversible engine, which we may assume to take its heat at \( T_r \) and to reject what it does not reject (if any) at some still lower temperature \( T_2 \). The second engine, considered separately, would give a second equation entirely analogous to the one already written; and we should have \( H_r/H_2 = f(T_2, T_2) \). But we might consider the two engines, coupled together, to constitute a single ideal reversible engine, taking in a quantity \( H_t \) of heat at \( T_t \) and rejecting a quantity \( H_r \) at the temperature \( T_r \). From this point of view, we could write \( H_r/H_t = f(T_t, T_t) \). But if we multiply \( H_r/H_t \) by \( H_t/H_t \), we obtain \( H_r/H_t = f(T_t, T_t) \). The function \( f \) must be of such a nature that we have the identical relation

\[
f(T_t, T_r) f(T_r, T_2) = f(T_t, T_2)
\]

whatever the values of \( T_t, T_r \), and \( T_2 \). Examination of this equation will show that the disappearance of \( f \) by the multiplication of the argument of the two terms in the first member involves that the function \( f \) shall be of the form

\[
f(T_t, T_r) = F(T_t) F(T_r)
\]

Hence we have the general relation

\[
H_r/H_t = F(T_t) F(T_r)
\]

\( H_t \) and \( H_r \) being, respectively, the quantities of heat absorbed and emitted by any ideal reversible engine at the temperature \( T_t \) and \( T_r \). From the preceding we must, therefore, reject heat except at \( T_t \) and reject none except at \( T_r \). The algebraic form of the function \( F(T) \) will
the pressure at the freezing point of water at one metre of mercury, and is graduated according to the Centigrade scale to read 0° at the freezing point of ice and 100° at the boiling point. (1) there is a constant term of 273.10° added to the reading of the thermometer in order to obtain the true reading of the instrument on the absolute scale, and also (2) a small variable term, whose value is given in the second and third columns accompanying table.

<table>
<thead>
<tr>
<th>Variable part of the correction to reduce to the absolute scale</th>
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<tbody>
<tr>
<td><strong>Temperature by Gas Thermometer</strong></td>
</tr>
<tr>
<td>Nitrogen thermometer</td>
</tr>
<tr>
<td>----------------------</td>
</tr>
<tr>
<td>0.000°</td>
</tr>
<tr>
<td>0.003°</td>
</tr>
<tr>
<td>0.006°</td>
</tr>
<tr>
<td>0.009°</td>
</tr>
<tr>
<td>0.012°</td>
</tr>
<tr>
<td>0.015°</td>
</tr>
<tr>
<td>0.018°</td>
</tr>
<tr>
<td>0.021°</td>
</tr>
<tr>
<td>0.024°</td>
</tr>
<tr>
<td>0.027°</td>
</tr>
</tbody>
</table>

Corrections here given are different from those usually quoted, but it is believed that they are more accurate. In the case of the hydrogen thermometer, it will be observed that for 50° C. to 100° C. they are negative. It is improbable this change of sign may not in a certain degree be due to differences between the hydrogen and nitrogen ther- mers, as deduced from the corrections given, correspond very faithfully with the differences as observed at the Interna- tional Bureau of Weights and Measures at Paris. In the smallness of the variable part correction, it is usually, in writings upon thermodynamical topics, to take note only of the large con- form that is to be added, and to treat e as though it were identical with the temperature as read from a constant- temperature gas thermometer, save for the addition constant, 273.10° C. In other words, if t absolute temperature corresponding to a gas thermometer is to be taken on the scale of a gas ther- mometer, it is customary to assume that 273.10° if the thermometer is graduated Centigrade plan, or $t = T + 273.10°$, if the is according to Fahrenheit.

Dents of thermodynamics are often confused by the introduction of the term "entropy"; and while this subject re- mains, the higher mathematics for its proper place, a few words may be given to it. When a body whose state at any given point is completely defined by two independent variables, undergoes any infinitesimal but finite change on account of corresponding infinitesimal changes in the two defining vari- ables, an infinitesimal amount of heat and it is to form a differential equation of the first and second degree, which will express the quantity of heat that is absorbed; the expression taken negative, if there is rejection of heat instead of absorption. We know, from the theory of differential equations, that the equation so formed can always be multiplied by some factor (the "integrating factor") which shall cause it to become an exact differential of some function of the variables whose differentials it contains; but, so far as pure mathematics is concerned, it is impossible to say, in advance, what that integrating factor will be, or what the nature of the function may prove to be, of which the modified expression is the exact differential. By the aid of the second law of thermodynamics, however, it may be shown that the reciprocal of the absolute temperature at which the infinitesimal transformation takes place is always an integrating factor of the differential equation in question. In other words, having written the differential expression for the quantity of heat absorbed by the body, we know that we only have to divide it by the absolute temperature of the body, in order to cause it to become the exact differential of some function of the variables. The function whose existence is thus indicated is called the entropy of the body, and in the study of thermodynamics this function is a very convenient thing, because its introduction simplifies the treatment of many problems. The main difficulty that students experience in connection with this is the difficulty of assigning to "entropy" any precise physical significance. It is probably better not to try to give any physical interpretation of this sort; for it is sufficient for many purposes merely to recognize the existence of the function, the very fact of its existence sug- gesting certain mathematical transformations which are exceedingly useful. The suggestion has sometimes been made, that it may prove to be possible to devise an instrument which shall enable us to measure the value of the entropy of a body directly, just as a thermometer measures the value of a temperature. If this could be done, the imagination of the student of thermodynamics would doubtless be greatly assisted; but it does not appear that the hope of discovering an instrument of this sort is at all well founded.

In studying the thermodynamic behavior of a body, the state of which is defined by holding as many of its measurable attributes as may be necessary in order to fix the condition of the body absolutely. These measurable attributes are represented by letters, and are taken as independent variables. Then, by treating these independent variables by known mathematical methods, we can deduce certain conclusions with regard to the behavior of the body itself. Theoretically, there is no reason why the number of independent variables may not be as great as we please; but in all of the more im- portant applications of thermodynamics it is found to be sufficient to take two independent variables. In the case of a gas, for example, it is usually sufficient to take two such variables, provided the gas is in a constant adiabatic and homogeneous throughout. When the possibility of internal motions is admitted or the gas differs in composition or in other respects in its different parts, it is necessary to take more than two variables, but this will not be considered in the present article. (Gibbs, in his classical papers on the Equilibrium of Heterogeneous Substances, published in the Transactions of the Connecticut Academy of Sciences) just previous to 1880, dis-
cussed many of the problems that arise when the composition of the substance under consideration departs from uniformity and homogeneity in any respect). Some latitude is permissible as to the variables that are selected for representing the state of the gas, but for the present we shall consider the state as being thoroughly defined when we know the pressure, \( P \), that it exerts upon each unit of area of the wall of its containing vessel and also the volume, \( V \), occupied by each unit of its mass. Other attributes of the gas may indeed vary, as well as \( P \) and \( V \); but if \( P \) and \( V \) are really sufficient to define the state of the gas completely, then these other attributes that are capable of variation at the same time must all be expressible as functions of the two variables \( P \) and \( V \). The temperature of the gas is one of the most notable physical attributes which is capable of variation; and it follows that there must be a relation connecting the temperature, \( T \), with the variables \( P \) and \( V \). This equation, which is called the characteristic equation or sometimes the elastic equation, may be written, tentatively, in the general form

\[
T = \frac{kPV}{P + V}
\]

while we know that an equation of this nature must exist, we do not know the exact form of the function \( P \) for any actual substance. For gases, however, we know its approximate form, throughout certain ranges of the variables \( P \) and \( V \). Robert Boyle showed that so long as the temperature of the gas is kept constant and the gas is not too highly compressed nor too near to its point of liquefaction, the volume varies very nearly as the reciprocal of the pressure, and Charles discovered (to express it in modern language) that so long as the pressure upon the gas remains constant, the volume is nearly proportional to the absolute temperature. Taking these two laws into account, it is evident that the form of the function \( P \) must be such that, for such values of the variables \( P \) and \( V \) as prevail under the conditions in which the laws of Boyle and Charles are nearly true, we must have

\[
\frac{RT}{V} = k
\]

where \( R \), \( T \), \( V \), and \( k \) are constants. If \( a \) and \( b \) are both zero, this reduces to the form previously given, same is true if \( P \) is very large indeed if the gas is very rare), since in that effect the small constants \( a \) and \( b \) negligible. If we assign to \( T \) any constant that we please, we may, from Van der Waals equation, trace all the possible relations \( P \) and \( V \) can have, at this one.

That is, when \( a \), \( b \), and \( k \) are known, we have assigned a fixed arbitrary value to \( T \) may then select any number of values and compute the value of \( P \) that corresponds to each one of them. If we plot the value computed, by laying off horizontal distance to represent the values of \( T \), and vertical distance to represent the corresponding values of \( P \) shall obtain a series of points representing various states that the gas is capable of assuming, while \( T \) keeps its fixed value, as we make the calculated points numerous enough, we may draw through them a curve which may be taken to represent the curves of states through which the gas as the pressure is continuously varied, the temperature remains constant. Such are called "isothermals," on account of the stancy of the temperature along them, such lines, as computed for as many different values of \( T \) from Van der Waals' equation, are shown in Fig. 1. If the high (gas at \( T_0 \), the isothermal line indistinguishable in form from the coring line as computed from the elastic of Boyle and Charles. If, on the other hand, the temperature is sufficiently low, it is only when the pressure upon the gas is increased. As the pressure grows \( P \), the volume of the gas diminishes; but as the temperature remains constant, any other sort of line can be found by fixing a point \( P \) and \( T \) is reached. When this attained, any attempt to further increase pressure merely results in the coring of the gas; the pressure remains constant as indicated by the horizontal line until at \( R \), the gas is entirely in the liquid form. Further application of \( P \),
causes but a slight reduction of volume; this which is indicated by the steepness of isothermal line above B. We have here bed what actually happens when the gas impressed along the isothermal \( T_1 \); but must be noted that the plot of this is normal from Van der Waals’ equation does have a straight part, \( ADB \), but a reversed between \( A \) and \( B \), as indicated by the line. If we could actually make the gas v this dotted line, we, of course, would have to from the gaseous condition into the liquid, without any discontinuity in state; s, in such a manner that it would never tility liquid and partly gaseous, and so we should not be able to see when the transition from one state to the other took It can be shown, however, that the states g gas which correspond to the dotted of the isothermal are essentially unstable, at the attempt to make the gas follow the portion of the theoretical isothermal is trying to balance a pyramid upon its point line \( ADB \) which the gas actually follows reference to the double loop, is in such a on that the areas of the two shaded loops equate each other. As was first shown by Maxwell. A ion of the dotted loops in the immediate ty of \( A \) and \( B \) can be actually realized e laboratory, by careful experiment; but often convenient, however, to assume the existent of a gas of this sort, for the purpose of illustrating general principles, of or obtaining approximate solutions of thermodynamical problems, and the ideal (but non-existent) gas which fulfills the relation of Boyle and Charles absolutely and under all circumstances is commonly called a “perfect gas,” though “ideal gas” would appear to be a preferable name. In applying the conception of a perfect gas, it is customary to assume the further constant that when a gas of this sort changes its volume at constant temperature, the heat that it absorbs is exactly equivalent to the external work that the gas does, in expanding against the external pressure that the containing vessel exerts upon it. In other words, it is customary to assume that the perfect gas, in addition to obeying the laws of Boyle and Charles perfectly, is also so constituted that its internal energy depends upon nothing but the temperature of the gas. The characteristic equations of Van der Waals and others are decided improvements upon the equation of Boyle and Charles, and they represent, very well, the nature of the phenomena that occur in a gas in the vicinity of the critical point. None of them, for any account, however, of the fact that a body is capable of existing in the solid state, as well as in the liquid and gaseous states; and the first characteristic

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Fig. 2.

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Fig. 3.

---

Fig. 4.

instability speedily becomes too marked to the experiments being carried far, temperatures intermediate between \( T_1 \) and e isothermals have a character intermedi between those shown for those tem- eratures. As we proceed upward from \( T_1 \), ops on the isothermals grow less and less unc, as is indicated by the partial, I isothermal, and we presently arrive at particular isothermal, \( T_2 \), where the loops ease to exist. At any temperature higher \( T_2 \), it is, therefore, impossible to liqyte is by the application of any pressure what- matter how great. Hence the tempera- of \( T_2 \) is the “critical temperature” of the gas. Critical Point. There is one point on critical isothermal (marked “C” in Fig. 2), at which the isothermal is precisely horizontal and it also has a point of inflection; and this corresponds to the critical point of the its temperature being the critical tempera- ture; i.e., the critical point of the volume and its are the critical pressure.

though gases obey the characteristic equa- of Boyle and Charles very closely when are not too highly compressed and not too to condensation, there is no gas which it rigorously under all conditions. It is

equation complete enough to take the solid state into account also, has yet to be proposed.

When a body passes from one condition of pressure and density to another, it either absorbs or emits heat, unless certain special conditions are fulfilled. To avoid circumlocution, we may speak of it as always “absorbing” heat; the emission of heat being considered to be merely a case of negative absorption. Suppose, for example, that a body is in the state corresponding to \( A \), in Fig. 2; and for definiteness let us suppose that the body under consideration is a gas, although the reasoning will apply equally well to a liquid or to a homogeneous, isotropic solid. The height of \( A \) above the horizontal reference line then represents, on some convenient scale, the pressure to which each unit of the bounding surface of the gas is exposed; and the distance of \( A \) from the vertical reference line at the left corresponds, upon some other convenient scale, to the volume occupied by a unit mass of the gas. If the gas be caused to pass from the condition represented by \( A \) to that which is represented by \( B \), by passing through all the intermediate conditions that are represented by the points that are intermediate to \( A \) and \( B \) on the line \( ACB \), the gas is said to pass from the state \( A \) to the state \( B \) along
the "path" $AB$. In genera, a change of this sort will be accompanied by an absorption of heat; the heat which is absorbed being partly expended in increasing the internal energy of the gas, and partly in the performance of external work. It is a consequence of the first law of thermodynamics that the change in the internal energy of the gas is entirely independent of the shape of the path $ACB$, and depends only upon the positions of the points $A$ and $B$. That portion of the absorbed heat which goes to increase the internal energy of the gas, therefore, depends upon nothing but the positions of $A$ and $B$. The case is different, however, with that portion of the absorbed heat which is consumed in the performance of external work. Consider, for example, the state of the gas at the point $C$. The pressure upon the gas, per unit of area of the containing vessel, is represented by the vertical line $CE$; and when the volume of the gas increases by the slight amount $EF$, the external work that the gas does is represented by the product of the pressure and the increase in volume; that is, it is represented by the area of the little rectangle $CIFE$. We must regard the gas made up of an infinite number of inextensible segments, each of which is typified by the little rectangle that is shown; and hence it follows that the total quantity of external work done by the gas as it is passed from the condenser at the position $A$ to the condition $B$ along the path $ACB$, is represented by the area included between the curve $ACB$ and the straight lines $AM$, $MN$ and $NB$. Obviously this area depends upon the form of the path $ACB$; and hence the external work that is done by the gas also depends upon the form of that path, and so also does that part of the heat absorbed along $ACB$, which is consumed in performing this work.

When a gas (or other body) describes a closed path, such as is shown in Fig. 3, and returns finally to its original state, then the internal energy of the gas also returns to its original value; and the total quantity of heat that is absorbed by the gas during its passage around the path is absorbed entirely by the external work that the gas does. That is, it is represented by the area of the closed path, as shown shaded in Fig. 3. A closed path of this sort is called a "cycle," and the total quantity of heat which the gas absorbs in various kinds of work is very important in many branches of thermodynamical reasoning. If $AB$ and $DC$, in Fig. 3, represent isothermal lines, and $AP$ and $BC$ represent adiabatic lines (that is, lines along which there is no absorption or rejection of heat by the gas), then the cycle $ABCD$ is called a "Carnot cycle," because it is the kind of a cycle that Carnot imagined his ideal, reversible engine to describe. (For Carnot's principle, enunciated in the earlier part of this article.)

When a gas is heated from $T_1$ to another temperature $T_2$, the quantity of heat absorbed in the process will depend upon the precise way in which the passage from one of these temperatures to the other is effected. If we imagine $T_1$ as the initial state of the gas, and let the curved lines, $T_1$ and $T_2$, represent the isothermal lines corresponding to the temperatures $T_1$ and $T_2$. If we cause the gas to pass, as in the previous case, from the isothermal $T_1$ to the isothermal $T_2$, along the path $AB$, then we are heating the gas while its pressure remains constant, and if we cause it to pass from $T_1$ to $T_2$, the vertical line $AB$, we are heating it with temperature remaining constant. If the difference in temperature between $T_1$ and $T_2$ is one unit and the mass of the gas is assumed unity, then the quantity of heat absorbed along $AB$ is the "specific heat at constant volume," and the quantity absorbed along $AC$ is the "specific heat at constant pressure." That these two specific heats are really will be evident from the fact that the external energy of the gas in the states $A$ and $B$ are not necessarily the same, unless the gas is assumed perfect; and also from the fact (for the heat that is absorbed along the path $AC$ to be partially expended in doing the external work represented by the shaded area along the path $AB$, there is no external work done.

The fact that in an ideal reversible engine the efficiency does not depend upon the nature of the substance whose expansion does the work, is sometimes hard to the beginner in thermodynamical reasoning to understand, for the reason that objections occur to him which appear to him to be unanswerable. But an answer, however, to every objection that may be urged: One of the commonest difficulties is this: In a steam engine, water is pumped into the boiler, and is then evaporated by the expenditure of a large amount of the steam is then passed to the cylinder of the engine and expanded, after which it is condensed and reconverted into water. The quantity of heat which is expended in the water is then converted into mechanical energy by the engine, and is merely rejected into the condenser. The engines have been designed and built, in which the water that is commonly used is replaced by some other liquid (such as ether or carbon disulphide) which has a much smaller heat of vaporization; in the belief that apparently large source of loss could be avoided by such engines have invariably proved less successful. Pointing any trifling superiority that have been shown from time to time being attributed to other causes than the smaller latent heat of vaporization of the working fluid. This for this is, that there is an intimate relationship between the pressure of a saturated vapor, given temperature, and the latent heat of vaporization of the liquid. This relation is known as the "second thermodynamic relation," and the "Clapeyron's equation." The elucidation of this matter requires a brief introduction of the infinitesimal calculus, and refers to the standard of the work of Clausius, and of the practical work that has been done since the Carnot engine has probably been inspired by the existence of the Carnot of the second thermodynamic relation. See Heaviside's "Theory of Heat," and of "Gas, Kinetic Theory," and of other similar articles in this volume.

Bibliography: Bryan, "Thermody"; Brown, "Mechanical Theory of Heat" (Brown's translation); Findlay, ""
THERMO-ELECTRICITY

If an electrical circuit is constructed partly of one metal and partly of another, and one of the points of junction between the dissimilar metals is heated while the other is kept cool, a current of electricity will be caused to flow in the circuit. This fundamental fact was discovered by Seebeck in 1821. The electricity thus generated is not in anywise different from that which is generated by an ordinary galvanic battery; but on account of its mode of production it is called "thermo-electric." The electromotive force that is set up in a circuit under the circumstances here described is always quite small, and its intensity depends (1) upon the nature of the two metals which are brought together (2) upon the difference in temperature between the two junctions where the dissimilar metals come together and (3) upon the average temperature of these junctions. For the sake of definiteness, let the two metals of which the circuit is composed be designated by the letters X and Y. The phenomena of thermo-electricity may then be described in the following mathematical language: It is known from experiment that when two metals X and Y are brought together so that their point of contact has the temperature T, an electromotive force exists between the two, which tends to send a current (say) from X into Y; and it is also known that the magnitude of this electromotive force can be expressed as a parabolic function of the temperature, T. Thus if E is the electromotive force in question, the facts of experiment can be adequately expressed by a relation of the form \( E = a + bT + cT^2 \); where a, b, and c are constants whose values depend upon the nature of the metals X and Y. In the actual circuit there are necessarily two junctions across which electromotive forces of this character exist. Let the temperatures of these junctions be respectively \( T_1 \) and \( T_2 \). Then the foregoing formula shows that across the junction whose temperature is \( T_1 \) there is an electromotive force of intensity \( E_1 = a + bT_1 + cT_1^2 \), tending to send a current from X into Y; and across the junction whose temperature is \( T_2 \) there is a similar electromotive force of intensity \( E_2 = a + bT_2 + cT_2^2 \), also tending to send a current from X into Y. These electromotive forces being opposed to each other, so far as the production of a current around the circuit is concerned, the effective electromotive force around the circuit is the difference between \( E_1 \) and \( E_2 \); and if we denote this effective electromotive force by the letter \( F \), we have

\[
F = E_2 - E_1 = b (T_2 - T_1) + c(T_1^2 - T_2^2),
\]

or

\[
F = (T_2 - T_1) [b + c(T_1 + T_2)].
\]

From this last equation it is evident that so long as the average temperature of the two junctions is constant (or, in other words, so long as \( T_1 + T_2 \) is constant), the electromotive force will be proportional to the difference in temperature between the two junctions. But it is also evident that when the average temperature of the two junctions is such that the relation

\[
b + c(T_1 + T_2) = 0
\]

is fulfilled (or, in other words, when the average temperature of the two junctions is numerically equal to \(-b/2c\)), there will be no thermo-electromotive force in the circuit (and, therefore, no current), no matter what the difference in temperature between the two junctions may be. This average temperature, for which there is no thermo-electric effect in a circuit, has a definite value for every pair of metals, and is known as the "neutral temperature" for that pair. The values of the constants \( b \) and \( c \), in the foregoing formula, could be determined experimentally, and recorded in tabular form for various pairs of metals. It is usual, however, to record the experimental data in a somewhat different manner, as we proceed to explain. If the average temperature \( T \) of the two metals be denoted by \( T_a \), then the formula for the effective electromotive force, \( F \), may be written

\[
F = (T_a - T) [b + cT_a].
\]

The constants \( b \) and \( c \) refer, it will be understood, to a particular pair of metals; but it is found that their values can be satisfactorily represented as the differences between constants which can be stated for the two metals separately. Thus \( b \) can be expressed in the form \( b = B' - B'' \) and \( 2c \) can be expressed in the form \( 2c = C' - C'' \); \( B' \) and \( C' \) being constants whose values depend solely upon the metal X, and \( B'' \) and \( C'' \) being constants whose values depend, in a similar manner, solely upon the metal Y. The expression for the effective electromotive force \( F \) can, therefore, be written thus:

\[
F = (T_a - T) [(B' - B'') + (C' - C'') T_a].
\]

The values of the constants \( B \) and \( C \) for the different metals vary somewhat with the physical conditions of the metals; but the data given in the accompanying table, in which the general nature of these constants, and will also suffice to represent, with some degree of approximation, the actual magnitude of the thermo-electric effects that may be expected from circuits composed of the metals there represented. In applying this table, temperatures are supposed to be expressed on the ordinary Centigrade scale, which defines the freezing point of water to be 0°, and the boiling point to be 100°; and the results are expressed in hundred-millionths of a volt, so that to reduce them to volts it is necessary to divide them by 100,000,000.

To illustrate the use of this table, let us compute the electromotive force of a circuit composed of iron and copper, when one of the junctions is kept at 0°C, and the other at 100°C. For iron we have \( B = +1734 \) and \( C = -4.87 \); and for copper we have \( B = +136 \) and \( C = +0.95 \). Hence we see that for this pair of metals \( b = +1734 - 136 = 1598 \), and \( 2c = 4.87 - 0.95 = 3.92 \). The thermo-electromotive force in the circuit is therefore,

\[
F = (1598 - 5.827 T_a).
\]

But we have assumed that \( T_a = 100° \) and \( T_a = \)
THERMO-ELECTRICITY

0°; hence \( T_1 - T = 100 \) and \( T = 50\)°, and we have \( F = 100(1598 - 5.82 \times 50) = 130,700 \). Dividing this by 100,000, we get \( F = 130.7 \), and the final conclusion is, that a thermo-electric couple of the kind described will give an electromotive force of about 0.000131 of a volt (in round numbers). To find the *neutral point* of an iron-copper couple, we merely have to set the expression \( 1598 - 5.82T \) to zero, and solve the equation for \( T \). Proceeding in this manner, we find that the desired neutral temperature is 274° C.

**Thermo-Electric Constants of Metals.**

<table>
<thead>
<tr>
<th>Metal</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron</td>
<td>+1734</td>
<td>-4.87</td>
</tr>
<tr>
<td>Steel</td>
<td>+1139</td>
<td>3.18</td>
</tr>
<tr>
<td>Silver</td>
<td>+611</td>
<td>1.10</td>
</tr>
<tr>
<td>Hard platinum</td>
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<td>-0.75</td>
</tr>
<tr>
<td>Magnesium</td>
<td>+244</td>
<td>0.25</td>
</tr>
<tr>
<td>German silver</td>
<td>-1207</td>
<td>-5.12</td>
</tr>
<tr>
<td>Zinc</td>
<td>+2174</td>
<td>+1.50</td>
</tr>
<tr>
<td>Br.</td>
<td>+2174</td>
<td>+1.50</td>
</tr>
<tr>
<td>Gold</td>
<td>+283</td>
<td>+1.02</td>
</tr>
<tr>
<td>Copper</td>
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<td>-0.03</td>
</tr>
<tr>
<td>Lead</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>Tin</td>
<td>-42</td>
<td>+0.39</td>
</tr>
<tr>
<td>Aluminium</td>
<td>-70</td>
<td>+0.00</td>
</tr>
</tbody>
</table>

Nickel is not included in the foregoing table, because its behavior is anomalous. From -18° C. to 175° C., its constants are \( B = -2204 \) and \( C = -5.12 \); but a short distance above 175° C. its values change profoundly, so that between 250° C. and 310° C., we have \( B = -8449 \) and \( C = +24.1 \). Above 340° C. we have, for this metal, the values \( B = -307 \) and \( C = -5.12 \). Antimony and bismuth are commonly used as the two metals in experimental thermo-electric circuits, since they yield an electromotive force which is larger than is obtainable under similar conditions by other metallic pairs. The thermo-electric constants of antimony and bismuth do not appear to have been determined with precision, however. When the average temperature of the two junctions (\( T \)) is about 20° C., the values of \( B + CT \) are approximately as follows: Bismuth, pressed commercial wire, -9700; bismuth, pure pressed wire, -8900; bismuth crystal, axially, -6500; bismuth crystal, equatorially, -4500. Antimony, pressed commercial wire, +600; antimony, pure pressed wire, +280; antimony crystal, axially, +2260; antimony crystal, equatorially, +2640.

When a thermo-electric couple is generating an electrical current, heat is absorbed at the hot junction, and given out at the cold one. If an electric current is caused to flow across the junction of any two dissimilar metals, heat is either evolved or absorbed at the junction; and if an evolution of heat is observed when the current flows across from the metal \( X \) to the metal \( Y \), there will be an absorption of heat when the current is made to flow from \( Y \) to \( X \). This phenomenon, which was discovered by Peltier, is known as the *Peltier effect.* Lord Kelvin showed that in the thermo-electric circuit the reversible heat effects are not confined to the junctions themselves. He showed, in fact, that when an electrical current is caused to flow through a wire that is locally heated by a gas flame or otherwise, the current tends to cause a displacement, along the length of the wire, of the point of maximum temperature. The effect may be illustrated by thinking of the wire as a tube conveying a stream of some real fluid; the fluid taking up more or less of the heat, and carrying it along in such a way as to shift the point at which the temperature is greatest. The analogy is imperfect, however, because in the case of electricity the heat travels with the current in some metals, and against it in others. This phenomenon (which is known as the *Thomson effect*) has an important bearing upon the theory of thermoelectricity, because in a thermo-electrical circuit the temperature is necessarily variable from point to point, and, therefore, the *Thomson effect* may (and in fact does) modify the phenomena considerably. The effect is zero in lead, but in nearly every conductor it is quite sensible. The consequences of the *Thomson effect* are discussed in two papers in the first volume of Lord Kelvin's 'Mathematical and Physical Papers.'

When a circuit contains several thermo-electric couples, with their successive junctions alternately heated and cooled, the total electromotive force that is produced is sensibly equal to the sum of all the electromotive forces that the several couples would produce, if each existed separately. Advantage is taken of this fact in the instrument known as the *thermo-pile,* which consists of a series of small bars of antimony and bismuth (often about 25 pairs altogether), disposed side by side so as to form an approximate cube and insulated from one another by strips of paper or other non-conductor. These bars are soldered together at the ends so that a current, in order to traverse the system, must pass back and forth through alternate bars of bismuth and of antimony; the passage of the current from bismuth into antimony being always effected at the right hand end of the little pile of bars, while the passage from antimony into bismuth is always effected at the left hand end. The two free ends of the thermo-pile being connected by a wire, a current of electricity flows through the circuit so formed, when either of the surfaces containing the soldered junctions is warmed, while the opposite one is kept cool. This instrument is used to a considerable extent for the determination of the approximate estimation of radiant heat; the current that it produces and which is measured by a delicate galvanometer in the external part of the circuit being taken as the index of the amount of the radiation. (Consult Tyndall, 'Contributions to Molecular Physics in the Domain of Radiant Heat'). The thermo-pile was invented by Nohili, but it was so greatly improved by Melloni that it is commonly credited to him.

Many attempts have been made to construct a thermo-electric combination that would yield a current of electricity intense enough to be of commercial utility; but while such attempts have been partially successful, there is no great reason to suppose that any new generators will ever be of much practical value. The difficulties are partly structural and partly theoretical. In order to realize any considerable electromotive force, the number of elements must be large; and the experience hitherto...
that a complicated thermo-pile is not very durable. Even if this objection overcome, there remains the serious there are theoretical reasons, based on the apparent changes in the temperature of the thermo-pile, as an instrument converting heat energy into electricity, can never be high. In a particular case, it was investigated by Lord Rayleigh, that a perfectly efficient detector of thermal energy is the thermo-pile that is not likely that an instrument of this kind would be of greater utility than this will ever be attained with a thermo-pile that is not likely to have a material value. A. D. RISTEEN, F. M. THERMOGRAPH (Greek, "heat-writing"), or self-registering thermometer, which an automatic record of varia- temperature is kept. Many different thermo-graphs have been made, of which wing may be especially noted: (1) the phic thermographs, in which the posi- mercury thread in an ordinary thermo- is photographed upon a moving sen- a, either continuously or at short in- f time; the moving sensitive film be- tered by clockwork, so that the time any given impression was made can be determined. (2) Metallic-strip thermo- which a recording pen is actuated by a metal composed of two substances differing in expansibility, riveted or soldered. When a strip of this kind is heated, it expands more than the other, its strip becomes curved, which serves as a measure of its temperature. The pen which makes the record on a disc of paper which is slowly revolved at a steady rate by means of a clockwork. (3) Electric-contact thermostats, in which a fine platinum wire is caused to touch, at intervals, into the open upper capillary tube of a sensitive mercury thermometer. When the wire touches the column, it completes an electrical cir- cuit, and the means the position of the thread in the thermometer is recorded. A manometric thermograph, in which the in a closed vessel filled with a gas is the index of the temperature; the being recorded automatically, and the ure being afterward inferred from the pressure, by means of a theoretical or else by direct comparison of the in- at different temperatures, with a thermometer. The pressure of an at the pressure of gas of this kind is known to be proportional to the absolute tem- of the gas, so long as the volume is tant). THERMOMETER (Greek "heat-meas- uses; e, heading Thermometry; and the racters of the common mercury-in-glass thermometer, which are certain of its uses. The mercury-in-glass thermom-
to do this the bulb is heated until the air that it contains is partially expelled and the open end of the stem is then dipped beneath the mercury. As the bulb cools, the air remaining within it contracts, and the stem is slowly filled until the bulb has become partially filled; this operation being repeated until the bulb is full. The instrument is next heated to a temperature considerably higher than the highest temperature it is to be exposed to in use, so that the mercury that contains becomes thereby so much expanded that it fills the entire stem and runs over at the top; and while the stem is still full in this manner it is sealed off at the end by means of a blowpipe. In the higher grades of thermometers, a tiny pear-shaped bulb is left at the top of the stem, partly as a precaution against the destruction of the thermometer in case it is accidentally exposed to too high a temperature in its subsequent service and partly as a aid in the calibration of the stem. When such a pear-shaped bulb is provided, the stem may be sealed off at the end while the internal space is exhausted by means of an air pump, instead of while it is filled with mercury; or it may be filled, above the mercury column, with dry nitrogen or some other inert gas. The glass part of the instrument having been completed, it remains to affix the scale to the stem. In high grade thermometers, the scale is engraved upon the stem directly; but in the cheaper forms it is usually engraved or stamped upon a piece of metal or of wood, to which the thermometer is finally secured. Let us consider the high grade instruments first and the cheaper ones afterward. Instruments of the former class are graduated by finding, experimentally, two definite points upon the stem, corresponding to two known temperatures; the two known temperatures which are selected for this purpose being the boiling point and freezing point of water. When these two points are found, the space between them is divided into a certain number of equal parts, which are called degrees. In determining the position of these points on a thermometer, the instrument is placed in a steam that is rising from water that is boiling freely under a barometric pressure equal to that which would be produced by a column of pure, ice-cold mercury, 760 millimeters high, at sea-level in latitude 45°. When the mercury column in the thermometer ceases rising and becomes stationary, the point opposite which it stands is marked upon the stem and is called the “boiling point.” If the barometric pressure under which the experiment is performed is not identically equal to the value assumed above, allowance must be made for that fact by the aid of the experiments of Regnault (or others) upon the variation of the boiling point of water per millimeter of elevation of the boiling point. The boiling point having been marked upon the thermometer as here indicated, the instrument is then placed in a mixture of water and tarry pulverized ice, as quickly as this can be safely done; and the point in which the mercury sinks is marked and called the “freezing point.” The distance, on the stem, between the boiling and freezing points, is then marked off, by means of a divide engine, into as many equal spaces as there are degrees between the freezing and boiling points of water (leaving for the filling of numbers to the degree-marks) the thermometer is complete. It may be of use that the thermometer is to be divided into degrees, or into tenths; but the operation is precisely the same, in this case, as if the division included the stem itself.

We could evidently divide the space between the boiling point and the freezing point into many equal “degrees” as we chose; for no reason, in the nature of things, a “degree” could not have any one size, just as any other size. It is done according to the manufacturers of thermometers and manufacturers of standards, but, in general, there has been some uniform practice in this respect; hence the manufacturers of thermometers have consistently conformed to one or the other of the standard systems. In France, and also in the United States and in England, it is customary to follow the plan introduced in 1744 by Fahrenheit and fixed by the French Academy about 1714. In this system the standard of temperature is divided into 180 equal spaces, or “degrees”; but the freezing point is here called 0°, and the boiling 100° (32° + 176° = 212°). There has been much discussion as to the reason that a temperature of 0° had for dividing the fundamental interval between two fixed points into 100 equal parts, the freezing point being called “zero,” or 0°, and the boiling point 100°. This method of graduation is known as the “Centigrade” (or “centesimal”) system. For general purposes in the United States and in England, it is customary for graduate thermometers to divide the temperature scale into 180 equal spaces, or “degrees”; but the freezing point is here called 32°, and the boiling point 212° (32° + 176° = 212°). This method of graduation is extensively used in Germany upon thermometers intended for household purposes; but for most other purposes in that country it has given way to the Centigrade system. After a thermometer that is to be used for precise measurement has been made and graduated, it is subjected to certain experiments, for the purpose of ascertaining the errors to which it may be liable. One of the most important of these is the “calibration,” or “calibration error,” which is due to irregularities of calibre as the bore of the tube may possess. In order to determine the calibration errors, a thread of mercury of equal length is detached temporarily from the bulb in the stem, by shaking the instrument, and the detached thread is brought into various positions, and in certain of these positions its length is measured. The difference between the measured length and the length of the thread before it was detached is the calibration error.
with great care. The volume of the
ng constant, it is plain that its length
ter where the calibre of the tube is
it will be where the calibre is rela-
ge. The details of the operation of
ng, the calibration errors that arise are very involved; but the general
1s in observing the lengths of dec-
de of mercury at different points of
and computing from these ob-
relate areas of cross-sect-
e of thermometer at various points. It is
ble to calculate a table of calibra-
s, by the aid of which it will be easy
ey given reading of the instrument,
nd what reading would have been ob-
the item had been of absolutely uni-
ure throughout.
ent among the other sources of er-
are four that merit special attention.
easure of a temperature, the
mometer is supposed to be fully
that temperature; but since the
 the stem must be seen in order to be
ten happens that the stem of an instru-
necessarily exposed to conditions of
 are materially different from which
r is submitted. Hence there is a "stem error" to a thermometer,
 fact that the mercury thread in the
ider (or hotter) than that in the bulb,
ore, shorter (or longer) than it really
re. The magnitude of this stem error
ually varies with the conditions under
ometer is used. It is always
 in amount and hence it is customary,
cuted scientific work, to design the
 that is to be used (including the
 ter itself), with special reference to
ility of keeping the stem error as
 possible. (2) When the barometric
 upon the bulb of the thermometer
 yield elastically to these vari-
d often to an extent quite suffi-
 ce the reading of the instrument by
 that cannot be neglected. The error
 cause can be determined and elimi-
 mental of the "external pressure co-
 which is obtained by subjecting the
 ter, at some fixed temperature, to a
 ge of external pressure and noting
 ion of the reading that this variation
 e produces. (3) The pressure of the
 pon the inner surface of the bulb may
 several causes, one of which is the
 the thermometer itself. If the stem
 ical position, the bulb will be sub-
 pressure due to the height of the
 ury in the stem; and when the
 er is horizontal, this static pressure
. In small thermometers the error
 cause is unimportant; but in instru-
 high precision, in which the stem may
 length, it must receive due
 ion. The constant which is used for
 for this source of error and which is
 ermined by experimenting with the
 er in different positions but at the
r the constant called the "in-
 sure coefficient." (4) It is found that
 of which a thermometer is composed
 certain anomalies in its expansion and
, when its temperature is altered.
ult in an apparent variation in the po-
 sition of the "zero point" of the thermometer,
 which is very troublesome when measurements
 of the highest precision are to be made. It is
 on account of this anomalous variation in the
 position of the zero point that the three kinds
 of glass mentioned in the earlier part of this
 article are recommended for the manufacture
 of the bulb; the variation of the zero having
 been studied in the case of these species of
 glass with great care. The phenomena as ob-
 served in the case of "verre dur" are thus
 described by Guillaume: "When a verre dur
 thermometer is quickly exposed to a tempera-
 ture of 100° C, after having exposed for a con-
 siderable time at the ordinary temperature of
 the laboratory, its zero point falls with such
 rapidity that after an exposure of one minute
 at 100° C, the displacement is practically com-
 plete. If the thermometer is then placed in
 ice-water, its zero ascends, for the first few
 moments, at the rate of about 0.001° C. per
 minute; but this rate diminishes rapidly. When
 a thermometer is maintained at a constant
 temperature, its zero point rises little by little
 and the change can be traced plainly for se-
 veral years. For thermometers of verre dur, the
 gradual rise at constant temperature amounts
 to about 0.001° C. per month when the ther-
 meter is two years old, and at the end of four
 or five years the motion is found to have
 diminished to about 0.0002° C. per annum." The
 ideal way of measuring a temperature, with a
 thermometer made of one of the three
glasses mentioned above, is as follows: The
 thermometer is exposed to the temperature that
 it is to be measured, and its zero points to a
 certain (presumably unknown) position. Af-
 ter the instrument has been read, it is intro-
duced, as quickly as is consistent with its
 safety, into a mixture of water and pulverized
 ice. The mercury sinks at once and soon at-
tains a stable position, which, on account of
 the slowness of the change of zero with
 falling temperature, is taken to be the zero
 corresponding to the higher temperature to
 which the instrument has been previously ex-
posed. In accordance with this plan, the
 temperature to be measured is found by sub-
 tracting the subsequent reading in ice-water
 from the reading obtained at the temperature
to be determined. The method here outlined,
 for eliminating the effect of variations in
 the zero point of a thermometer, is known as
 the "method of movable zeros," and is now
 adopted at practically all of the centres of ac-
curate thermometry except Kew, for tempera-
tures between the freezing and boiling points.
 It is not yet possible, by any method of pro-
 cedure, to determine temperatures more than a
 few degrees below the freezing point, or more
 than a hundred degrees (Centigrade) above
 the boiling point, by the aid of a mercury-in-glass
 thermometer, with a precision comparable with
 that which is attainable within the fundamental
 interval that lies between 0° C. and 100° C.
 It is to be understood that in the foregoing
 discussion of the errors of the mercury-in-glass
 thermometer, we have been treating of the de-
termination of temperatures to such a degree of
 precision that the final error is not to exceed
 (say) 0.005° C. No such elaborate care is re-
 quired, if the only object of the measurement is
to determine the temperature to the nearest degree, or half-degree.

Passing now to the consideration of the ordinary thermometers that are used about the household and by amateur meteorological observers, it may be pointed out, first, that in the manufacture of a thermometer that is to be sold at retail for (say) 50 cents, it is not commercially possible to engrave a special scale for each instrument. In making cheap thermometers it is customary to stamp for the scales in large numbers and then to blow the bulb of each instrument to such a size that the scale will be as nearly as practicable adapted to the finished thermometer. This can be done, by an experienced glass-worker, with greater accuracy than might be supposed; but it is evident that no high degree of precision can be attained in this way. The scale and the rest of the thermometer being adapted to each other as nearly as is commercially practicable, the thermometer is adjusted with respect to the scale by exposing it to some known temperature (say 70° F.) in the vicinity of the temperatures at which it is most likely to be used and then securing it in such a position that the point on the stem to which the mercury rises comes opposite the proper mark on the scale. Such a thermometer will give readings that are not greatly in error at temperatures near the one at which it is standardized; but at other temperatures any two such thermometers will necessarily diverge by an amount which depends upon the judgment and skill of the workmen who blew the bulbs and who endeavored to give them capacities adapted to the sizes of the degrees upon their respective graduated scales.

For further information concerning the methods that are used in precise thermometry consult Guillaume, "Thermometric de Precision"; and for the historical aspect of the subject consult H. Carrington Bolton, "Evolution of the Thermometer." Consult also, Preston, "Theory of Heat."

Gas Thermometer.—A thermometer in which the temperature is measured by the change of volume, or pressure, of a mass of gas enclosed in a glass envelope. The gases that are used for this purpose are air, hydrogen and nitrogen; and thermometers containing these several gases are respectively called "air thermometers," "hydrogen thermometers," and "nitrogen thermometers.""  

Alcohol Thermometer.—A thermometer in which the temperature is indicated by the expansion of alcohol (instead of mercury): coloring matter of some kind being dissolved in the alcohol, so that the column of fluid in the stem of the instrument may be distinctly visible. Alcohol has a larger coefficient of expansion than mercury, and hence, for the same sizes of bulb and stem, the degrees are lower upon a thermometer containing it. Alcohol can also be used at temperatures that are low enough to do so; it may be the thermometer, to the freezing point of the mercury. No great degree of precision can be attained with the alcohol thermometer, however, partly because the liquid wets the glass and thereby cause the instrument to read too low when the temperature is falling, and partly for other reasons. For the measurement of temperatures approaching the freezing point of mercury (37.8° F. below zero) the International Bureau of Weights and Measures prefers a thermometer filled with toluene that is filled with alcohol; the toluene thermometer being apparently capable of much more accurate results. Owing to the fact that alcohol boils at a much lower temperature than water, the alcohol thermometer cannot be graduated by the method given for the mercury instrument, since exposure to a temperature of 212° F. would cause the alcohol to have a vapor pressure so high that the bulb would be likely to burst. These thermometers, therefore, graduated, most commonly, direct comparison with a standard mercury-glass instrument. The expansion of alcohol by heat is not strictly proportional to that of mercury and hence if the scale of the mercury thermometer is taken as the standard, the degree marks upon the alcohol thermometers not be spaced at uniform intervals; the spaces are in fact smaller at low temperatures than at higher ones, as will be seen by examining any good alcohol thermometer that is adapted for observing a considerable range of temperature.

Maximum and Minimum Thermometers are thermometers which automatically register the highest or lowest temperatures to which they have been exposed during a given period. In the Rutherford maximum thermometer the capillary stem of the thermometer is horizontal and as the mercury rises it leaves before it a tiny index of iron or steel, within the tube; and the index, being left in its most extreme position attained by the mercury, indicates the highest temperature to which the instrument has been exposed. In the Rutherford minimum thermometer a similar index is used, but the thermometric column is heaped up with alcohol and the index lies within it. When the temperature falls, the end of the column of alcohol in the stem rises; and its position is indicated by the index remaining in the alcohol. But when the temperature rises again, the alcohol flows around the little index (which does not fill the capillary tube), and so holds it in the position to which it had been driven by the rise of temperature, and which is the lowest. In both forms of thermometer the index is returned to a suitable position for a new observation by the aid of a small hook. In the Negretti and Zambra maximum thermometer the capillary tube is partially filled with alcohol so that when the mercury flows outward readily enough as the temperature rises, a fall of temperature at the moment causes the mercury thread in the bulb to break at the obstruction, so that the mercury column, having been exposed can be read in the usual manner. The broken thread can be returned to the partially empty bulb by means of the instrument, or by whirling it in a circle.

Clinical Thermometer.—A form of alcohol thermometer in which is used by physicians for determining the temperature of the human body.

The graduation on these instruments is such that the temperature can be read to a degree or so; and the entire instrument.
THERMOMETER

The graduation rarely extends below 0 or above 115°F, the normal temperature of the body being about 98°F. In using the instrument, the bulb is placed under the patient's tongue or in the arm-pit.

Differential Thermometer.—A form of thermometer designed to indicate the intensity of radiant heat. The solar radiation consists of a thermometer with a bulb, the stem being sealed into a heated sphere of glass, so that the blackened bulb comes in the centre of the sphere. Sunlight is allowed to fall upon this thermometer and also upon a similar one with a silvered and polished black absorber most of the radiant heat, while the red one reflects most of it. The difference in the readings of the two instruments is used to indicate the intensity of the radiative energy falling upon them.

Setting Thermometer.—A form of thermometer with a constriction in the bulb that is used to determine the temperature of a liquid contained in it. The temperature is recorded by means of a clock, which is arranged to stop when a bulb has cooled to a certain temperature that is lower than the one being recorded.

p-Sea Thermometer.—An instrument of the setting type, for observing temperature at various depths in the sea. It is used in a very strong case and is reversed at which the temperature is determined at moderate depths the reversal is by sending a weight down along the wire; but at greater depths the upper mechanism is usually actuated by a smaller weight which is arranged so as to begin its ascent when the thermometer starts on its way to the surface of the sea.

istering Thermometer.—Any thermometer which automatically records its own readings.

Point Thermometer.—A thermometer to the determination of the temperature of a liquid, which will be deposited from the saturated vapor of the instrument. This consists of a thin receptacle of polished silver, shaped like a drop of water. A meter is placed in each of these, and the tubes are then partially filled with ether. This volatile liquid is then cooled in a cold bath. A current of air passes through the ether by means of a stirrer, and the rapid evaporation cools the lid and its contents (including the thermometer), and the observation consists in noting the temperature of the ether, when the exterior of the silver tube containing the silvered tube of the thermometer is cooled, the tin and tube of silver, which is not cooled, is noted by observation in the room. The observation consists in noting the temperature of the ether at the time the experiment is made. The temperature of the mercury is compared with a standard temperature, and the temperature of the ether is given in degrees.

Differential Thermometer.—An instrument for measuring or detecting differences of temperature, with reference to the absolute value of the temperatures that are compared. Sir John Leslie's form, as improved by Rumford, consists of a horizontal tube, turned upward at the two ends, and there provided with a pair of equal bulbs of considerable size. The bulbs are filled with air, and a small quantity of colored liquid is placed in the horizontal tube which joins them; the liquid serving to separate the air masses that the bulbs contain, and also as an index for reading the instrument. So long as the temperatures of the two bulbs remain equal, the pressure of the air will be the same in each, and the liquid index will not move. If one of the bulbs is warmed slightly more than the other one, however, the air that contains expands and forces the liquid index toward the cooler bulb; the amount of this displacement indicating the difference in the temperatures of the bulbs. This form of differential thermometer is not used to any great extent at the present time, the thermo-pile (see Thermo-electricity) and the platinum resistance thermometer (see Thermometry) having almost entirely displaced it.

Wet Bulb Thermometer.—A thermometer whose bulb is covered with thin wet muslin, and which is used for determining the amount of moisture in the air. In practice, the wet bulb thermometer is used in connection with a similar thermometer having a dry bulb, the two being whirled through the air together, or having a current of air directed upon them by a fan, or otherwise. The evaporation of the moisture about the wet bulb causes the instrument to become cooler than the other one; and the difference in the readings of the two thermometers, when taken in connection with the reading of the wet dry one, enables the observer to determine the degree of saturation of the air at the time the experiment is made. Tables for this purpose are published by the Weather Bureau.

Weight Thermometer.—A thermometer consisting of a bulb provided with a capillary outlet in the place of the usual stem. In this instrument, the bulb is first weighed while empty, and again when filled with ice-cold mercury. It is next heated to the boiling point of water, and the mercury which escapes is collected and weighed. These data enable the observer to calculate the fraction of the original weight of ice-cold mercury that is lost upon heating the bulb to the boiling point. To determine any other temperature, he fills the bulb, as before, with ice-cold mercury, and then exposes it to the temperature that is to be measured (this temperature being assumed to be higher than the freezing point of water). Collecting the mercury that runs out of the bulb, and expressing its weight as a fraction of the weight of ice-cold mercury that was present at the outset, he has only to compare the fraction so obtained with the fraction obtained in the first experiment, in order to be able to calculate, by a simple proportion, the temperature desired. The weight thermometer is a convenient instrument to use, but it is simple in theory, and is free from certain of the errors to which ordinary thermometers are liable.

Metallic Thermometer.—A instrument in which temperature is determined by noting the change of form or of length that a metallic
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strip experiences when it is heated. In Bréguet's instrument, three thin strips composed respectively of platinum, gold and silver are rolled together into the form of a single ribbon, the gold being in the centre. The ribbon is then coiled into a spiral, with the silver at the end that is to be kept at a constant temperature, while the other end is exposed to the temperature that is to be measured. Of these four general methods, the first two have been longest and most commonly employed; and the particular instruments that have been most extensively used for putting them into practice are known respectively as the "mercury-in-glass thermometer" and as the "gas thermometer." The mercury-in-glass instrument is described under Thermometry, and the gas thermometer is described in the present article, below.

The gas thermometer was probably the first form of thermometer to be constructed. The mercury-in-glass instrument followed, and for many years was used almost exclusively for the measurement of temperatures, double and single, on account of its simplicity and the ease with which it can be used. But as the science of thermometry developed, and increasing refinement in temperature determinations was demanded, it was found that the mercury-in-glass thermometer is liable to serious errors on account of anomalous expansions and contractions of the glass envelope; errors which were of little or no importance when a determination of temperature to the nearest quarter of a degree or so was considered sufficiently accurate, but which were of paramount importance when it was proposed to determine a temperature to the hundredth or thousandth of a degree. The errors due to the cause in question can now be eliminated in large measure by making temperature determinations by the "movable zero" method (see Thermometer); but physicists nevertheless prefer to follow the lead of Regnault, who, in his celebrated "Fourth Memoir" (1847), recommended the employment of the gas thermometer as the standard for the establishment of the temperature scale; and the gas thermometer is still the standard in all work of high precision. The great advantage of the gas thermometer consists in the fact that the coefficients of expansion of gases are much more accurately known than those of mercury, and the effects of anomalous changes of size in the glass bulb are of correspondingly less importance.

The gas thermometer is made in two general forms, according as it is desired to measure the temperature by the expansion of the gas at some constant pressure, or by the increase in the pressure of the gas at some constant volume. The latter plan being the one that is now by far the commoner in accurate work, we shall describe it first, and at some length.

The constant-volume gas thermometer is shown, in its essential features, in the accompanying illustration. It consists of a bulb, A, of considerable size, which is connected, by means of a capillary tube, with a mercury manometer, M. At a is a mark upon the tube leading to the gas bulb, and care is taken, whenever an observation of any kind is made, to have the level of the mercury in the short arm of the manometer exactly at the same level. The volume of the thermometric gas may always be rigorously the same. A movable reservoir of mercury, V, is connected with the bulb A for this purpose, by means of a flexible tube; so that by raising or lowering V the mercury
The volume of the gas in the bulb remains constant. If \( T \) be the temperature as thus defined, and \( P \) is the pressure prevailing within the bulb \( A \), then we have, from the definition of temperature, \( T = CP \), where \( C \) is a constant for the particular thermometer in operation. (It is to be observed that \( P \) is the total pressure to which the gas in \( A \) is subjected. It includes not only the pressure that is read from the manometer \( M \), but also that barometric pressure that prevails at the same time in the air of the laboratory; for this barometric pressure acts upon the top of the mercury column, and it is, therefore, to be added to the reading of the manometer \( M \).) To deduce the value of the constant \( C \), we may subject the bulb \( A \) successively to the steam from boiling water, and to a mixture of ice and water, as described under Thermometer. The total pressure upon the gas in the bulb being noted in each case, let us suppose that it is \( P_0 \) at the freezing point, and \( P_{100} \) at the boiling point. Then the foregoing equation, when applied to these two cases, takes the following forms, respectively: \( T_0 = CP_0 \), \( T_{100} = CP_{100} \); \( T_0 \) being the temperature of the freezing point according to the scale of this thermometer, and \( T_{100} \) being that of the boiling point. We may define \( T_0 \) or \( T_{100} \) however we please, and then find the corresponding value of \( C \); but it is desirable that the scale of the gas thermometer shall be as closely as possible like that of the ordinary mercury-in-glass instrument; and in order to fulfil this condition it is found to be best to subject the gas thermometer scale to the condition that the difference between \( T_0 \) and \( T_{100} \) as determined by the gas thermometer, shall be numerically the same as the difference between the freezing and boiling points, on the ordinary mercury-in-glass scale. In other words, it is found to be best to have the average size of the degrees the same on the two instruments. In scientific work the Centigrade scale is used in practically every instance; and if we adopt it here, we shall have the relation \( T_{100} - T_0 = 100^\circ \), if the condition just mentioned is to be fulfilled. From this and the preceding equations we easily find that \( C(P_{100} - P_0) = 100^\circ \), or \( C = \frac{100}{(P_{100} - P_0)} \); so that when we know the values of \( P_{100} \) and \( P_0 \) by direct observation, we are prepared to determine \( C \) at once, and hence to calculate the gas-temperature, \( T \), corresponding to any given pressure \( P_0 \), by means of the relation \( T = CP \). It will be seen that the zero of the gas thermometer scale does not coincide with the freezing point of water, but that it is very much lower. The gas thermometer could not give \( T = 0 \), for example, unless \( P = 0 \); that is, not unless the temperature was so low as to cause the gaseous pressure to disappear altogether. The zero point from which the indications of the gas thermometer are counted, according to the formula given above, is called the "natural zero" of the instrument; and in order to be able to compare the gas scale with the scale of the ordinary mercury-in-glass thermometer, it becomes necessary to know what the temperature of freezing water is, as read from the gas scale. To determine this, we make use of the relation \( T_0 = CP_0 \). Substituting \( T_0 \) in the value of \( C \) as already found, we find that \( T_0 = 100P_0 \). Now the quantity \( (P_{100} - P_0)/P_0 \) is known as the "coefficient of expansion at constant volume" for the gas. (The name is somewhat absurd, it is true, be-
cause there is no expansion at all, if there is no change of volume; and it would be more accurate to designate this fraction as the "coefficient of increase of pressure" at constant volume. It appears, therefore, that the temperature of melting ice on the scale of the constant-volume gas thermometer, is numerically equal to 100 times the reciprocal of the coefficient of expansion of the gas at constant volume. Having found \( T_g \), we have only to subtract it from every reading of the gas thermometer, in order to reduce that reading to its corresponding value as reckoned from the freezing point of water. If we call the values of \( T - T_g \) as computed for any given gas thermometer, the "reduced readings" of that thermometer, then we find that the reduced readings of the nitrogen, hydrogen, air and carbon dioxide constant-volume thermometers are all nearly identical, and that they are all closely comparable with the readings of the ordinary mercury-in-glass thermometer. All two constant-volume gas thermometers be filled with the same gas in different states of density, then the reduced readings of the two are very nearly equal, but yet not necessarily identical.

The coefficients of expansion at constant volume of certain of the more important thermometric gases are given in Table 1, as deduced from a careful analysis of the data given by Chappuis, Regnault and numerous other experimenters of high standing. The "initial pressure" signifies the pressure on the gas in the thermometric bulb, when the bulb is surrounded by ice and water; this pressure being given as the most convenient way of fixing the density for which the coefficients were determined. Two coefficients are given for air at each initial pressure, because it appears to be

<table>
<thead>
<tr>
<th>Gas</th>
<th>Initial pressure 1,000 mm.</th>
<th>Initial pressure 760 mm.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrogen</td>
<td>0.0006324</td>
<td>0.0003924</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>0.0006240</td>
<td>0.0004604</td>
</tr>
<tr>
<td>Carbon dioxide</td>
<td>0.0006288</td>
<td>0.0004604</td>
</tr>
<tr>
<td>Air</td>
<td>0.0006286</td>
<td>0.0004604</td>
</tr>
</tbody>
</table>

impossible to decide, from the observations thus far made, which one of these values is most likely to be correct, the available measures falling into two general groups, one of which favors one of the two values, while the other favors the other one. In Table 1 the values of \( T_g \) are also given, for convenience of reference.

The International Committee of Weights and Measures, in consideration of the difference that exists between the reduced reading of constant-volume gas thermometers, adopted the following scale for the measurement of temperature, calling it then "International temperature." The scale adopted is the Centigrade scale of the constant-volume gas thermometer, in which the hydrogen has a density, such that its pressure, at the freezing point of water, is to that due to a column of ice-cold one metre (1,000 mm.) high. The units are understood to be "reduced," as described above, so that the thermometer "0" at the freezing point is 100\(^\circ\) at the scale point. The ideal scale would of course be absolute thermodynamic scale (see Thermodynamics); but the corrections that are made in order to reduce gas thermometer readings to this scale are still too uncertain to be adopted in precise thermometry.

2. Comparison of Readings of Constant Volume Gas Thermometers and the Curie-Verrier-Dub Scale ("Reduced" Thermometers).

<table>
<thead>
<tr>
<th>Gas</th>
<th>Hydrogen (or air)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>-10(^\circ) C.</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>-10 007(^\circ)</td>
</tr>
<tr>
<td>Carbon dioxide</td>
<td>+10 005</td>
</tr>
<tr>
<td>Air</td>
<td>+10 010</td>
</tr>
</tbody>
</table>

In Table 2 comparative readings are of the mercury-in-glass ("Verrier Thermer"), scale, and the scales of constant-volume hydrogen, nitrogen and carbon dioxide thermometers, in which the "initial pressures" are 1,000 millimetres of mercury. The significance of the table will be made plain in the following example: If all of the thermometers were exposed to a temperature which the "reduced" reading of the instrument was 30\(^\circ\) C, then the nitrogen thermometer would read 30001\(^\circ\) C, the carbon dioxide thermometer would read 30034\(^\circ\) C, and the mercury-in-glass thermometer would read 30031\(^\circ\) C. Readings given in the second column were taken from experiments made upon a constant-volume mercury thermometer; but Chappuis stated that reduced readings of the air thermometer of the nitrogen thermometer are practically indistinguishable; and hence this column serve for each of them.

In the constant-pressure gas thermometer, temperature is defined as proportional to volume of a fixed mass of gas which expands in such a manner that the pressure remains constant. Regnault experimented with thermometers of this class, and considered them to be distinctly inferior in accuracy to the others, which have already described. This is now admitted by Regnault has met with nearly every subsequent authority in experimental physics, and hence the constant-pressure gas thermometer has not been extensively used in practical work. P. H. L. Callendar, in fact, is almost the prominent advocate of the constant-pressure gas thermometer at the present time. He died the constant-pressure gas thermometer a valuable instrument in its own right, but one that is even more useful than those of the constant-volume the.
revised a very ingenious form of the pressure instrument, which certainly
overcome most of the objections that I urged against it in the past. By
the Byland and Harker and Chappuis have shown that the reduced plat
temperature can be determined in terms of the reduced gas thermometer scale by means
of a simple equation of the form:

\[
T' = T + A \cdot \left( \frac{T}{100} - 1 \right)
\]

A being a constant whose value is to be determined experimentally. Callendar and Griffiths,
for the purpose of determining A, recommend that the resistance of the platinum coil of the
thermometer be observed at the temperature of boiling sulphur; the "reduced temperature" of
this boiling point being, according to their experiments with the constant-pressure air ther-
rometer, 444.53° C. (Ewermortopulos states that the boiling point of sulphur on this scale is
between 443.58° and 443.62° C. See Grey Proceedings of the Royal Society, p. 339. Compare,
also, Callendar and Moss, in the same publication, 1909 A, 83, p. 106). The platinum-
thermometer gives great promise of being a highly valuable instrument in the future.
Indeed, it is so already; but it does not yet appear to be capable of determining the absolute
values of temperatures closer than to 0.01° C. It may be used as a differential thermo-
meter, however, so as to give results of a far higher order of accuracy. For this purpose
two similar coils or strips of platinum are used, these being placed in two of the arms of
a Wheatstone's bridge, so that the smallest difference in equality in their resistances can
be observed. (See Resistance, Electrical). Langley's bolometer is an instrument of this
sort. It is used to explore the solar spectrum, and consists of two strips of platinum foil,
which are placed across the spectrum to be examined, with their edges toward the source
of the light. The two strips are placed in the two arms of a sensitive Wheatstone's bridge,
and so long as both the strips are exposed to radiation of the same intensity, the balance
of the bridge is preserved. When one of the strips coincides with a Fraunhofer line, how-
ever, while the other is still exposed to the full radiative power of the source of light, the
balance is destroyed, and the existence of the line is thereby demonstrated, even though
the line be in the infra-red, where it is not visible to the eye.

Thermo-electric couples have been used to a considerable extent for the measurement of
temperature, and Regnault experimented with them somewhat, but showed that they are dis-


tinctly inferior in accuracy to the other known methods of determining temperature. At ex-
ceedingly low temperatures, however, they are often of great value. Wroblewski, for example,
made use of thermo-couples quite extensively for temperature measurements in his researches
on the critical points of the gases which are liquefiable only at extremely low temperatures.
The platinum resistance thermometer is more generally favored, however, for this purpose;
though it cannot be used for temperatures too close to the absolute zero on account of the
anomalous and sudden changes of resistance that occur in that region. (See Resistance,
Electrical). At these extremely low tempera-
THERMOPHONE.—THERMOTAXIS

tures the helium thermometer is still useful, however.

Consult Guillaume, ‘Thermometrie de Precession’ and Preston, ‘Theory of Heat.’ See also, the numerous scientific papers of Kamerlingh-Onnes relating to low-temperature research.

A. L. A. R. E. T. E. N. A.

THERMOPHONE, a resistance thermometer (see THERMOMETER), in which the galvanometer that is most commonly employed is replaced by a telephone. Two coils of platinum wire, which are exposed to the respective temperatures that are to be compared, are introduced into two of the arms of Wheatstone’s bridge whose remaining arms contain constant resistances. The telephone is placed in the cross-arm of the bridge. An alternating or pulsating current of low frequency is used in making the observation, and when the bridge is in balance, this fact is indicated by the silence of the telephone. See Warren and Whipple, ‘The Thermophone,’ in The Technology Quarterly, Vol. VIII, page 125.

THERMOPOLIS, Wyo., town and county-seat of Hot Springs County, on the Chicago, Burlington and Quincy Railroad, and on the west bank of the Bighorn River. It is noted for the large hot springs which issue along the river bank at this place. These springs are considered curative for rheumatism and similar ailments. They are protected as a State reservation. Pop. 1,500.

THERMOPYLÆ (Gk. θερμόπυλα hot gates), in classical geography, a pass on the southeastern frontier of Euboea, Greece, leading from Thessaly into Locris, and on the route of the only good road from Thessaly to central Greece. It was situated between the range of Mount Eta and an inaccessible morass which bordered the Malian Gulf; and in breadth it was a narrow tract of perhaps some 50 feet. Its name was derived from the presence of thermal springs. As the only means by which a hostile army might penetrate from northern into southern Greece, it held a peculiar strategic value in Greek history. It is celebrated as the scene of the defense by Leonidas (q.v.) and the 300 Spartans against the vast host of Xerxes (q.v.) in August, 480 B.C. The account of this battle given by Herodotus has been generally followed. Xerxes, numbering the numbers of the Hellenic defenders (5,280), not counting the Locris, whose numbers are not known, sent against them the Minoa and Cissians with instructions to take them prisoners, and bring them before him. When they failed in this attempt, they were massacred. The picked 10,000, called the ‘Immortals,’ were not forward; but, handicapped by the number of their spears, they were no match for the Hellenes, of whom few fell, while 300 Persians lost. The sea was now in great perplexity, when the pernicious ‘Malian wind’ came to tell them of the way which led across the mountain to Thermopylae. This was immediately crossed by the Boeotians and the Epinaspids, and the rest of the army crossed at Thermopylae. The Persians arrived in the rear of Thermopylae soon after mid-day of day. Tidings of their coming had already been brought to the Greeks by scouts. The Spartans and the Thespian (7,000) and the Thebans (400) were compelled of the Spartans and Thespian, all fell; the Thebans, few escaped. To the Greeks that the Persian arrow darkened the Spartan Diogenes is said to have said, “Good; then we shall fight in the shade!”

Through deposits from the Spero other streams, great alterations have place at Thermopylae, so that it is not pass but a swampy plain. Consult Schal ‘Untersuchungen der Thermopylen’ and various standard histories of Greece also GREECE, ANCIENT.—History.

THERMOPYLÆ OF AMERICA, applied to Fort Alamo, Texas. See THE THERMOMETER.

THERMOSCOPE (Greek, to heat), any instrument for indicating temperature. The term is commonly applied to such instruments as indicate temperature only, or a very limited number of temperatures; or to those which are used for giving changes or difference of temperature or giving the magnitude of these changes. The forms that have been to instruments of this kind are so many, to be almost past enumeration. As a subdivision, the instrument may be considered, indications depend upon the melting alloys. A temperature or device that contains buttons or wires of a number of whose several melting points are known; the observation of temperature by this the instrument is exposed to the ten under examination, and a note is made of the alloys melt, and of which is melted. If T is the melting point of the alloys that have melted, i.e., the melting point of the most fusible alloys that have not melted, we can then the temperature under consideration higher than T, but lower than T, end by using the melting points in the arts, it is quite well known, in this manner, that the temperature between certain limits. A thermoscope can only indicate certain limits between a temperature lies is called a “disc of thermoscope.” Continuous thermoscopes, are capable of affording an actual measure of any temperature within their range, commonly called “thermometers,” while resemble the ordinary mercury-in-glass thermometer. A thermometer in temperature is inferred by noting the resistance of a coil of platinum wire. For example, is called a “platinum resistance thermometer.” See PYROMETER; THERMOMETER; THERMOMETER.

THERMOSTAT, a device in which the variation of heat is utilized to expand a long strip of metal; it can be utilized to regulate a damper or to control approximately uniform steam pressure.

THERMOTAXIS, the regulation temperature of the body. The principal causes of animal heat are muscular exercise and combustion of food, involving also...
n and liberation of carbon dioxide. Body nature remains about normal under many circumstances through the balance main- tained by the nervous system between its pro-
duction and its dissipation. The chief avenues of action are radiation from the surface of the body, the expired air and the excreta. Fec-
tion or fever is believed to be due to an overproduction of heat, to an underelimination of waste substances. The overproduction is believed to arise from an increased combustion especially of cutaneous impulses and the tempera-
ture of the blood, is governed, it is gener-
ally believed, by two nerve-centres, one control-
ating production, the other heat-dissipation.

Thermotropism, a tendency toward.

Thermopoda, a sub-order of dinosaurs (q.v.).

Thersites, ther-sî-têz, according to Homer, the ugliest man in the whole Grecian army that beleaguered Troy. He was a malic-
ious and slanderous brawler whom Ulysses publicly beat and brought to tears for his in-
sulting attack on Agamemnon. He was eventually slain by Achilles for piercing with his spear the eye of the dead queen of the Amazons, Pen-
theseilea, whom he had also spoken of with contumely.

Thery, Edmund, French writer on eco-
nomics: b. Ragnac, France, 1854. He is a com-
mmander of the Legion of Honor, member of numerous societies interested in his line of work and has represented his government in various economic missions to several countries. His writings include 'Europe et Etats-Unis d'Amerique' (1890); 'La France economique et financiere pendant le dernier quart de siecle' (1900); 'La Banque de France de 1897 a 1909' (1910); 'L'Europe economique' (1911); 'Le regime actuel des chemins de fer en Russie' (1913), etc.

Thesem, thè-sè-sôm, or Theseion, thè-sè-sôm, a temple in ancient Athens dedicated to the commemoration of Theseus and his ex-
plorers. It stood on an elevated site north of the Areopagus (q.v.) and in early Christian times was used as the church of Saint George of Cappadocia. Within its precincts is said to have deposited the bones of the hero which he had brought from the island of Scyros, but archaeologists do not support this claim. The temple was begun 465 B.C. Many consider it to have been originally dedicated to Heracles or Hephaestus, but there is no reason to doubt that it is actually a Theseion. It was constructed of Pentelic marble in the purest Doric style and is technically to be described as an amphiprostyle, hexastyle peripteral temple, with prostyle, or opisthodromos or epinae. The façade and the entablature are each six columns; the sides 13 each; their height being about 30 feet. A fragment of the portico and the roof of the stella are still standing. There are also some noteworthy remains of the statue with which the building was adorned by sculptors of the school of Phidias. On the metope are set forth the exploits of Theseus and Heracles and the frieze of the cella is also in part standing. The dimensions of the building are roughly to be estimated at 104 × 45½ feet. Consult Stuart and Revett 'Antiquities of Athens' (London 1762-1816); Leake, 'Topography of Athens' (London 1841); Dyer, 'Ancient Athens, Its History, Topography and Remains' (London 1873).

Theseus, the sôs or the-sè-sôs, in Greek legend, a king of Athens and national hero of Attica, son of Aigeus by Æthra, the daughter of Pittheus of Troizen, in Peloponnesus. He was educated at Troizen, at the house of Pittheus, and passed for the son of Poseidon (Neptune). When he came to years of maturity he was sent by his mother to his father, and a sword and sandals were given him by which he might make
himself known to Θεσμοθήτης (q.v.) in a private manner. On arriving at Athens he narrowly escaped being poisoned by Medea, the sorceress, but managed to reach the town by the sword, and received Theocles as his successor on the throne. He next caught alive the wild Marathonian bull; but a much more important service was the slaying of the Minotaur and the freeing of Athens from the tribute of seven youths and seven maidens annually sent to Crete to be devoured by that monster. (See Μινώταυρος.) Fear- ing his son had perished while in Crete Θεσμοθήτης destroyed himself; hence Theocles on his return succeeded his father as ruler of Athens. The Athenians were governed with mildness, and Thesmophoria were made regular and enacted new laws. The number of the inhabitants of Athens was increased: a court was instituted, which had the care of all civil affairs; and Thesmophoria were made the government democratic, while he reserved for himself only the command of the armies. To him also the Athenians ascribed the union of the towns of Attica into a single state, with Athens at the head, and the division of the people into the three classes of Euxines, Hetaerai, and Demes (nobles, free- men and mechanics). Perhaps the most celebrated of the events in the career of Theocles after the slaying of the Minotaur was his war with the Amazons. He is said to have invaded their territory and carried off their queen, Antiope (according to another account, that with which the readers of Chaucer and Shakespeare are familiar, Hippolyta). The Amazons in their turn invaded Attica, and a battle was fought in the city of Athens itself. Thesmophoria were victorious, and the Amazons driven out of Attica. He was absent from Athens on various expeditions, and when he returned the Athenians had forgotten his services. He retired to the court of Lycomedes, king of Scyros, who threw him down a deep precipice. In 469 B.C. his bones, as supposed, were found by Cimon in Scyros, and brought to Athens, where they received a magnificent burial. Statues and a temple (the Thesenum, or, as was also called, and festivals and games were publicly instituted to commemorate his actions. A portion of the temple still remains standing. What shreds of history, if any, there may be in the accounts of Thesmophoria cannot be ascer- tained. (Consult Harrison, J. E., Mythology and Monuments of Ancient Athens (London 1890); Lübker, F., Realexikon des Klassischen Altertums (Leipzig 1914); Schultz, A., Dies Thesee (Brussels 1874).

THESMOPHORIA, a pagan festival of ancient Greece. It was celebrated only by women, in honor of Demeter. Thesmophoria (“the Lawgiver”) was a festival of agriculture, and thereby of orderly social life and the marriage. At Athens the festival extended to three days, beginning with 24 October. On the first day there was a procession to the temple on Demeter at Eleusis, southeast of the city, on the second a fast; and on the third day, called Kallichorión (“the bearer of a fair offspring”), a general and frequent indulgence.

THESMOTHETHEΣ, θεσμοθήτης (from a Greek word meaning however), one of the six inferior archons at Athens who presided at the election of the lower magistrates, received criminal informations, decided civil cases and performed duties.

THESPESUS, also called Clason, and sometimes referred to as a prehistoric being, who lived in the upper Cretaceous strata in Wyoming, and Colorado show it to have resembled Iguanodon. It was upwards of 30 feet and stood from 10 to 25 feet high. Like many of its species it was herbivorous and had a long forward body by its heavy tail complete sketches of the animal are found in principal museums. (See DINOSAURS.) C. Marsh, O. C., ‘The reconstruction of Cretaceous Dinosaur’ (in Transactions of the Connecticut Academy of Sciences, Vol. XI, New York 1892).

THESPIS, Greek author. He was a of Icaria, a deme of Attica, lived in the 6th century B.C., and is the inventor of tragedy, as he added to the dithyrambic choruses of the feast of Baals the actor, who, when the chorus was silent, actually recited a mythical story; and probably on dialogues with the leader of the chorus appearing successively in different characters. This was a decided step toward drama.

THESALONIANS, Epistles to Authorship— While Paul's authorship of First Epistle to the Thessalonians has sionally been questioned, the consensus of critical opinion is that the present text is the most unanimous in favor of its genuineness, and that is the expression, and not the actual use of Paul's teachings elsewhere. In the whole tone and temper there is in harmony with Paul's teachings elsewhere. The external evidence is strongly favorable to the style and vocabulary as being Pauline; the doctrinal content, while not very rich in harmony with Paul's teachings elsewhere, is above all, in its whole tone and temper unmistakably and inimitably an outpouring of the very heart and soul of the great author. As concerns the Second Epistle the case is somewhat different. Though the evidence is even stronger than for the First letter, yet its Pauline authorship has been far more disputed. The difficulties which have raised grow mainly out of its relation to the First Epistle, and practically reduce to the following: (1) the resemblance in portions of the letters, considered by some to be too coincidental to permit us to think of the second as an independent composition; in answer to this it is said that this likeness covers no more than a third of the letter, and may easily have grown in many cases, as, for instance, before writing Paul might have glanced at a copy of his first letter, (2) the difference in the tone and temper of the two letters, a fact for which several explanations have been offered, as that first letter had failed helpfully to affect the Thessalonians, he might naturally be more formal and distant in his letter, or, as Harnack has suggested, it may have been intended solely for the section of the church, while the other letter, as the main body of the church, which was less in origin, and more loyal to Paul; and (3) the difference in the eschatological teaching, however, does not amount to a conclusive one, but is to be regarded partly as a consequence...
rstanding of the teaching in the first
which misunderstanding seems in spite
correction still to continue in some
and partly is an addition of certain
in Paul’s doctrine of the Last Things
ad not come out earlier, resulting in an
it change of emphasis, but not in a res-
tency. Certainly the difficulties in the
explaining the letter as a forgery have
und greater than of accepting it as
and consequently the later criticism
is exclusively to favor the Pauline author-
both Epistles.

and Place.—From the First Epistle
1 comparison with Acts it is easy to
2 second great missionary journey,
ond European city in which Paul
was Thessalonica, the modern Saloniki.
he established a church at once,
very success caused him to be driven
the city after a stay possibly of only three
months, about a whole of a few weeks.
From there Paul went to Greece,
short stay at Athens and establishing
a year and a half at Corinth. It
that Timothy, who was sent back from
to Corint and poses the Thess-
Church, rejoined Paul at Corinth with
rt, and the first letter must have been
ast at once. According to some
l letter followed the first even without
for an answer and in any case the
cannot have long, a few weeks.
The most common dating is in
of 51, but chronologists vary two
ears either way so far as the years to
gnied to the various events of Paul’s
concerned. These Epistles are accord-
nong the very earliest New Testament
ly James and Galatians being con-
by any to be earlier.

itions of Composition.—It is plain
Thessalonians as well as from Acts
recipe of Paul and of his teaching
ssalonica was peculiarly prompt and

In a very short time a church was
ed, consisting partly of Jews, but
for proselytes and Gentiles, including
f those who were converted in Thess-
aul turned back to Thessalonica as
here his work had been a peculiar de-
nd the mutual affection of the Apostle
verts must have been unusual. But
at the longest had been brief, and in
his plans and endeavors he had found
ssible to return, while at the same time
reason to fear that misrepresentations
iating circulated touching both his failure
it them and his purposes in his mis-
work and his relations to his converts.
he report of his messenger Timothy, and
from a letter to Paul from the church,
ions from which some have thought they
embodied in this letter, it appeared that
one hand a certain fanaticism showing
morbidity and on the other a hand
or doctrinal and spiritual uncertainty had
up in the Church. It was to remedy
itions that Paul wrote his first letter.

Paul is traditionally held that Paul’s letter mainly ac-
ited its purposes, but that either by the
of the messenger who carried it or by
written response from the Thessalonians them-
self, Paul learned that some disorders con-
tinued and that his teaching about the Last
Things needed supplementing to correct mis-
understandings, and thus arose the Second
Epistle.

Contents.—These letters are peculiar in
that two of Paul’s fellow-workers, Silas and
Timothy, are associated with him in the address
(i, 1), though it is plain that in composition and
thought as well as in personal relations it is
definitely his own letter. In 1 Thess., Paul gives
an explanation of his failure to return to
them, adding an assurance of his strong affect-
ion for them and an assurance of his confidence
in their affection for him and their continuing
faith in Christ, all so put as to answer any mis-
representations of him and his work which
might be current (i, 2-iii, 13). Then come
various moral injunctions, first, to chastity, and
then to brotherly love, with which is associated
the duty of diligent labor (iv, 1-12). There
follows the correction of the painful un-
derstanding of some of the Christians as to
their friends who had lately died, by the
assurance that through their resurrection they
would be at no disadvantage when Christ should
return, and encouragement for all in reference
to the same return (iv, 13-v, 11), and, finally,
warnings against various disorders, couched in
brief injunctions, and a few salutations (12-28).
In the second letter, after a brief greeting
(i, 1, 2), Paul gives utterance to a remarkable
expression of thanksgiving and prayer (1, 3-12) ;
then corrects the misunderstanding of what he
had said in his first letter, assuring them that
before the “Day of the Lord” there was much
history to be made, including a great apostacy
(ii, 1-12); a brief encouragement to faint-
hearted brethren follows (iii, 13-iii, 5), and
warnings to the idle and dissolute (iii, 6-15),
the Epistle ending with a word of explanation
of how the Apostle added to his dictated let-
ters a certificate in his own handwriting and
the benediction with which he commonly closed his
letters (iii, 16-18).

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THESALONICA. See SALONICA.

THESALY, thes’a-li, or THESSALIA,
the northeastern division of ancient Greece
proper, bounded on the north by the Cam-
burnian Mountains, separating it from Mac-
donia; on the west by the chains of Fundus
and Tymphreus, separating it from Euboea; on
the south by Mount Oeta, separating it from
Etolia, Doris and Locris; and on the east by
the Ægean Sea. The rich plain enclosed bet-
ween these mountains belongs almost entirely
to one river basin, that of the Peneus (Salam-
chernia), which traverses it from west to east,
and finds an outlet into the Thermaic Gulf through
the vale of Tempe. It was especially famed
for its fine breed of horses and its skilful horse-
THETFORD MINES — THIBAULT

men. The name of Thessaly was derived from the Thessali, a Greek people who are said to have come into this land from the west, and who became the governing class in the country. Thessaly was broken up into separate states loosely united under a tagus, and long exerted no influence on the government of Greece generally; but it rose for a brief period to a position of greater consequence when (about 375 B.C.) Jason of Pherae, having been elected tagus, brought the whole of Thessaly completely under his power, and began to threaten the rest of Greece, but the confederacy was again weakened after his assassination in 370 B.C. Thessaly afterward became dependent on Macedonia, and finally was incorporated with the Roman Empire. In 1933, after the fall of the Byzantine Empire, Thessaly came, with the rest of the imperial dominions, into the hands of the Turks, and till recently formed a part of the Ottoman Empire. The greater portion of it was in 1881 incorporated in the kingdom of Greece. The Greco-Turkish War of 1897 was fought principally within the borders of Thessaly. Consult Baedeker, K., 'Greece' (4th English ed., Leipzig 1909); Kent, R. G., 'A History of Thessaly from the Earliest Historical Times to the Accession of Philip V of Macedon' (Leicester, Pa., 1904); Leake, W. M., 'Travels in Northern Greece' (4 vols., London 1835); Philipson, A., 'Thessaliens und Epirus' (Berlin 1897); Wace and Thompson, 'Prehistoric Thessaly' (Cambridge 1912).

THETFORD MINES, Canada, town, in Merrit County, on the Quebec Central Railway, about 76 miles south of the city of Quebec. It is chiefly known for the deposits of asbestos in the neighborhood. There are numerous small industries. Pop. about 7,500.

THETIS, the, in Greek mythology, a daughter of Nereus and Doris, therefore one of the Nereids. Her nuptials with Pelcus were celebrated on Mount Pelion, and were honored by the presence of all the gods except Eris or Discord, who was not invited, and who, to avenge the slight, threw in among the company a cup of discord. By Pelcus she became the mother of Achilles (q.v.).

THEURGY, from the Greek theurgia, meaning divine work, and used among the ancients to signify supernatural agency in individual human affairs, or in the government of the world. Hence the act or art of invoking deities or spirits, or by their intervention conjuring up visions, interpreting dreams, receiving or explaining oracles, etc.; the power of obtaining from the gods, by means of certain observances, words, symbols or the like, a knowledge of the secrets which surpass the power of reason, to lay open the future, etc. The word also means that source of magic which more modern professors of the art attribute to primitive methods of spiritual activity, as evidenced in the natural man. Also a system of supernatural knowledge or power believed by the Egyptian Pharaohs to have been divinely communicated to them, and by them held to give access to spiritual realities.

THEURIET, Claude Andre,ouch port and naval officer, born in France, on 16 April 1867. He married in Paris, received his brevet in 1887 and in that year entered the department of the Ministry of Finance. Soon, however, he turned his attention to literature. In 1896 he was elected a member of the French Academy, having received the prix l'litre in 1860. His poem includes 'Le chemin des bois' (1883); 'Le Bleu et le noir' (1873); 'Nos amours' (1868); and 'La route des saisons et des mois' (1891). He also published 'Jules Bastien-Lepage, l'homme et l'artiste' (1885), but a best known by his novels, among which are 'Nouvelles intrises' (1870); 'Mille Grignon' (1874); 'Chantons dangereux' (1881); 'La Chanoinesse' (1893), etc. He was the author of some 60 works of fiction. He also wrote several dramas including 'Jean-Marie' (1871); 'Le maison des deux Barbeaux' (1885), and 'Jour d'été' (1901).

THIAN-SHAN (t'é-an'shán) MOUNTAINS, central Asia. See TYSHAN.

THIAZOL DYE STUFFS. See COAL-TAR COLORS.

THIBAULT, Jacques Anatole France, critic and novelist: b. Paris, 16 April 1844. He is known wherever French is read and the Latin genius appreciated as a master, and was called by Lemaire, one of the shred-est of his contemporaries, 'the ultimate flowering of the Latin genius.' Son of a Parisian bookseller, another 'France' and a veteran of the body-guard of Charles X. Anatole grew up in the bookish atmosphere which he has conveyed marvellously into several of his stories as he has also his father's character. A Parisian of the Parisians, he was named officer of the Legion of Honor in 1895 and received into the Academy in 1896. For the rest the story of his life is in his writing. Besides early verses his well-nigh 50 volumes embrace charming books of autobiographic 'truth and humour' such as 'Le livre de mon ami' (1895), 'Pierre Nozière' (1900) and 'Les désirs de Jean Sève' (1912); books of philosophical criticisms, as he openly professes, evidencing his own way of thinking in noting the ways of others; chief among them articles collected from 'Le Temps' in five 'Périodes littéraire' (1888-93) and 'Le génie latin' (1913); dramatic experiments, among which 'Thaïs' is best known; an extended controversial biography, 'La vie de Jeanne d'Arc' (1901); expressions of fervid patriotism in stress of war, such as 'Sur la voie glorieuse' (1915), and, finally and chiefly, a long series of books which in the course of fiction express all the manifold phases of his political observations, his social aspirations and indignations, his philosophic speculations and the play of his recreative imagination in evoking the thought and life of a long out-lived past. This fierce, taken chronologically, gives the clue to the development of France out from the dilettante scepticism of Renan, through epicureanism, to its higher and also its lower sense, into an earnest, though still ironic, socialism, with occasional glints of fierce intolerance for ob-scurantists, reactionary or clerical. Outstanding among these books are such as 'Les confessions de Silvestre Bouvard' (1881), his second novel, whose social sympathy with childhood and love of humanity have attracted writers of distinction, among them Lafcadio Hearn, to attempt its translation. 'Balthazar' (1900) and
THIBAUT—THIERRY

(1900), a mediæval and an early in study, show a curiously subtle "piety agnation with impiety of thought, to his own mind were 'La Rotisserie de e Pédague' (1883) and 'Les opinions comme Coingard' (1893) in which the epicurean and courteous figures of reappear in 18th century dress and an comes playful mouthpiece for the ironic ion of a scepticism more radical in than the same Montaigne. Each book, is, is a chain of sparkling epigrams in the laughing philosopher unmarks the uses and inconsistencies of private and morals and life. French politics are the theme of four notable volumes of 'e contemporaire, 'L'orne du mail' ; 'Le mannequin d'osier' (1897) ; s au d'améthyste' (1899) and 'M. et à Paris' (1901), all jewels of grace, ve city. Thibaut's thought takes a serious bent as he is drawn into the lists ola against militarist and religious re- slaves revealed in the Dreyfus case. Of this idence is seen in 'Craignebulle' (1903) ; and his sequel 'Craignebulle' (1906). D'political matters 'L'ile des pingouins' and 'Les dieux ont soif' (1912) as in 'La vie de Jeanne d'Arc' (1908) 'Opinions sociales' (1902). All these whatever their form, are in effect criti- f contemporary life. He has himself at he counts criticism as possibly the e evolution of literary expression, well to a highly civilized society which is old traditions, the last in date of all forms and destined to absorb all. All illustrate an idea of style which he has nairly in 'Le jardin d'Épicure' (1894) ple style," he says, "is like white light; complex but does not seem so. In writ- at appears a beautiful and pleasant sim- is really the result of careful arrange- and strict economy in the use of the parts of speech." In this art of hiding France is almost supreme. See Le de Saint-Simon. B. W. B. Consult an translation of 'Works' edited by c Chapman (London 1908-19) already 27 volumes. Of separate works re many other versions. For criticism see Amédée Simon Dominique, French historian and politi- b. Blois, 2 Aug. 1797; d. Paris, 26 March 1873. As a young man he entered the service of the Minister of Marine, and in 1826 became professor of history at Besançon. His ideas being ultra-liberal, his course was suspended by the Minister of Public Instruction. In 1830 he became prefect of the department of Haute-Saône, and in 1838 returned to Paris, where he was appointed master of petitions addressed to the council of state. He held various other political appointments; but continued his his- torical investigations in the special field he had chosen: the origins of French national history; the early peoples and the neighboring races; and the conquest of the Gauls by the Romans. In 1841 he was elected a member of the institute; in 1860 he became a senator, and in 1868 he received the cross of the Legion of Honor. His works include 'Histoire des Gaulois' (1828); 'Histoire de la Gaule sous l'administration romaine,' (1840-47); 'Histoire d'Attila' (1856); 'Tableaux de l'empire romaine' (1862); 'Récits de l'histoire romaine au Ve siècle' (1860); 'Saint-Jérôme' (1867), and 'Chrysostome et Eudoxie' (1873).
THIERRY—TIERS

THIERRY, Jacques Nicolas Augustin, French historian: b. Blois, 10 May 1795; d. Paris, 22 May 1856. He was educated in the Normal School at Paris in 1811, and in 1813 became teacher in a provincial school. The following year, he quit this occupation and returned to Paris, where he embraced the socialistic views of Saint Simon, and became his secretary and his coadjutor in literary work, and in 1816 published a treatise of his own, "Les nations et de leurs rapports mutuels." Perceiving the theoretical vacaries of his master, he separated from him in 1817, and became one of the conductors of the journal Le Censeur Européen. Shortly afterward he became a contributor to the Courrier Français, in which, in 1820, he published 10 letters on the history of France, which attracted attention. His celebrated work on the Norman conquest of England, "Histoire de la conquête de l'Angleterre par les Normands," was published in 1825, and by the interest of the narrative, brilliance of style and novel mode of treating the subject, attained great success both in France and in England. From his close application to work, he became in the following year almost entirely blind, and at the same time was attacked by a nervous disorder, but still pursued his literary labours. An enlarged edition of the letters formerly written by him for the Courrier appeared in 1827, under the title "Lettres sur l'histoire de la France." In 1830 he was elected a member of the Academy of Inscriptions and in 1834 published "Dix ans d'Etudes historiques." About this time he was entrusted by Guizot, then Minister of Public Instruction, with the editing of the "Recueil des monuments inédits de l'histoire du tiers-état," for the collection of documents relative to the history of France. To this publication he prefixed an "Essai sur l'histoire de la formation du tiers-état," separately published in 1833. In 1840 he published "Recits des temps mérovingiens," which gained him the Gobert prize of the Academy of Inscriptions. There exist translations of his chief works in English. There is a complete edition of his works (10 vols.) by Consul Valentin, "Auguste Thirry" (Paris 1895).

TIERS, t'ær, Louis Adolphe, French statesman and historian: b. Marseilles, 15 April 1797; d. Saint Germain, Paris, 3 Sept. 1877. He studied law at Aix, and was admitted to the bar there in 1818. Desirous of a larger theatre for his ambition he went to Paris in 1821, and having got an appointment on the staff of the Constitutionnel, then the leading Parisian journal, he soon attracted attention by his articles in that paper. Journalism soon ceased, however, to supply sufficient stimulus to his active intellect, and he undertook his "Histoire de la Révolution française," having as colleague Felix Bodin, whose name appeared with his in the first two volumes. The work was completed in 10 volumes in 1827. On the formation of the Polignac Cabinet, Thiers founded with Armand Mignet, the National, whose first number appeared on 1 Jan., 1830. The new democratic organ exercised a decisive influence on public opinion, and the famous ordinances, the signal for the revolution of July, were now issued. Upon this Thiers counseled the issuing by the journalists of a revolutionary manifesto.

It was signed by 43 names. To escape arrest, Thiers fled, on the night of the 28th, to the neighborhood of Saint Denis, accompanied by Mignet and Armand Carrel. Louis-Philippe, becoming king of the French, Thiers was soon made councillor of state in the department of finance. He was elected deputy for Aix, and after the death of Casimir Perier became Minister of the Interior in the Cabinet of Soulétot, October 1832. He next filled offices of from France, and returned in 1836 as President of Public Works and again became Minister the Interior, but in consequence of differences with Soulétot and Gérard gave in his demis 11 Nov. 1834, but soon resumed office as Mortier. He again retired in February 1839, but a few days after returned to power as a foreign minister and president of the council. These offices, after many vicissitudes, he again held in March 1840. Taking a strong interest in the Eastern question he declared in favor of Mehemet Ali of Egypt against Turkey, neither the king nor the chambers wished to resort to extremities, and the policy of having received a grave check he retired in the Cabinet 29 Oct. 1840. He now devoted himself to historical pursuits, and his "Histoire Consulat et de l'Empire," was completed in 1862, in 20 volumes. The revolution of February, 1848, found him prepared accept the republic; and he was a member of the Constituent and then of the National Assembly. After the coup d'état of 1851 he was banished from France, but returned in Aug. 1852. After an absence of 12 years from public life he was chosen in the elections of 1860 deputy for the department of the Seine, and elected in 1869. In this position he regained much of his early popularity. He combated energetically the project of war against Prussia, but France was unprepared, and after the defeat of Sedan the courts of London, Vienna, Saint Petersburg and Florence to seek assisitance against Prussia, but all that he could obtain was a promise that the four great powers would support the proposal of a Consult Valentin. Auguste Thirry.
with one of the thimbles, the performer proceeds to shift the thimbles, covering the pea now with one, now with another, and offers to bet any bystander that no one can tell under which thimble the pea is. The person betting is seldom allowed to win, the pea being extracted by sleight-of-hand. In the United States the trick is commonly known as the shell-game and is frequently played at race-track meetings, rural fairs and other gatherings.

**THIONVILLE**, tê-ôn-vôl, or **DIEDENHOFEN**, dé-dên-hô-fén, Lorraine, an important railway centre, 18 miles north of Metz, stands in a level plain on the Moselle River. Its manufactures comprise gloves, thread and nets; and there are sawmills and tanneries. Thionville is the seat of the Lorraine iron industry. There is some trade in corn, hemp, flax, fruit, vegetables, grain, wine and wood. An important fair is held annually. In the Franco-German War of 1870–71 Thionville was invested after the battle of Gravelotte, and after the fall of Metz it was besieged with vigor. On 28 Nov. 1870, it was occupied by the Germans. It suffered severely by the siege. It was restored to France under the terms of the armistice of 11 Nov. 1918 and confirmed by the Treaty of Paris of 1919. Pop. 14,184.

**THIRD CENTURY.** The central interest of this period lies in the fact that the Roman Empire at the climax of its power and extent, just when presumably it ought to be consolidating itself for a still greater future, began slowly but surely to crumble under the attacks of the barbarians. Toward the end of the century the Goths in Dacia gave the first visible hint of that power to defeat Roman armies which portended so clearly the fall of the empire. In the last decade the Saracens, a predatory Arab tribe, who are usually supposed to have come into history much later than this, began to make themselves felt. Inspired by Mohammed and unified by religious fanaticism in the 7th century they were to prove more fatal to the empire than even the Goths. The success of the barbarians was favored by the disorder consequent on the debauchery of the Praetorian guards. Septimius Severus (emperor 193–211) halted the barbarians for a while but Rome’s decline and fall was inevitable. Severus reigned with vigor as became “the soldiers’ emperor,” defeating his competitors Niger and Albinus, but cruelly putting to death large numbers of the adherents of his rivals, thus further demoralizing the time. His reign came in the midst of a financial crisis for the empire during which the government resorted to debasement of the coinage to bolster up its credit. Severus was the first of Rome’s rulers to lay the foundation of a great private fortune. As emperor he was an extremely hard worker, always at work by dawn, and devoted long hours every day to the duties of his position. On his return to Rome in 202 he was greeted with a popular reception but refused a triumph and in spite of his fortune always lived very modestly. Like many a great ruler, he attempted to found a dynasty and when he died at York (Britain), he bequeathed the empire to his two sons, Caracalla and Geta. Caracalla, having killed his brother, gave a frightful example of imperial misrule. Undoubtedly insane,—nothing else could account
for his utter cruelty.—Gibbon terms him "a common enemy of mankind." During their father's lifetime the two sons had used the family fortune in racing and gaming, caring only to associate with gladiators and chariot drivers. The elder, Septimius, from his love for the more remote provinces, planned the conquest of Caledonia and it was this that brought him to Britain, where he erected the wall known by his name between the Forth and the Clyde. After Caracalla had expended the family fortune he went to the greatest length of cruelty and injustice to secure more. One good result of his desire for money was the granting of Roman citizenship to all the provinces so as to secure the right to levy direct taxes and impost on inheritances (213). In imitation of his father Caracalla visited the various provinces of the empire, but instead of benefiting from his stay, each in turn became the scene of his rapine and cruelties. Having heard that the citizens of Alexandria disapproved his mode of life he ordered a general massacre of the inhabitants. He was finally put to death by his soldiers in the East and was followed by a series of emperors in rapid succession, most of them violent. After Caracalla, who succeeded Caracalla, was put to death within a year by the soldiers. A feminine intrigue then seated Helioagabalus, an Oriental priest, on the throne. He was worse, if possible, than Caracalla and his name has become a byword for utter viciousness. After four years he was succeeded by Alexander Severus, who meant well and accomplished much, but the rule of Rome was now become a difficult task. He tried the expedient of paying an annual tribute to the Goths to keep them from molesting the empire. This token of weakness had, as might have been expected, exactly the opposite effect. Severus was murdered by a mutiny in the army (235) and was succeeded by Maximinus who bravely led his army against the Dacians and defeated them, but was assassinated by his own people near Aquilia the next year. Ballinnus and Gordian reigned very briefly, though Gordian defeated the Persians under Sapor and the last of the line met his death from Philip the Arab who succeeded him in 244.

In 248 Philip was succeeded by Decius who bitterly persecuted the Christians and was slain by the Goths who invaded the empire the following year. The Huns on the Caspian Sea came into history at this time as a new set of enemies for the empire. Emperors continued to succeed each other nearly every year — Gallus (251), Aemilianus (253), Valerian (254) who five years later was defeated, made prisoner and flayed alive by the Persians. Then came Gallienus and the era of the Thirty Tyrants, none of whom deserve particular mention.

The most interesting character of the 3d century is Zenobia, queen of Palmyra (died 274). Her husband, Odaenathus, had set himself up as ruler of Palmyra during the weakness of the empire in the time of the Thirty Tyrants, and she survived to continue his rule. After his death, calling to her aid the mass of the Palmyrene forces and her beauty was such that, if tradition be true, she far excelled the Egyptian queen. For a time during the disturbed state of the Roman Empire, she exercised sway over a large territory, boldly proclaiming herself Queen of the East and bade defiance to Rome. The ruins of Palmyra were among the first to be excavated and studied in modern times and this gave the town a special interest. The Arabs had for long told wonderful tales of a ruined city in the Syrian Desert, but their description was of remains so extensive and magnificent that it seemed that there must be Oriental exaggeration in their accounts. At the end of the 17th century, European travelers reached the site of Palmyra, however, and found that the Arabian stories minimized rather than exaggerated the truth. There was, for instance, a colonnade stretching almost a mile in length and many of the marble columns constituting it are still standing amid the sand of the desert.

Palmyra, as the inscribed monuments show, came into prominence about the beginning of the 2d century. Adrian took the city under his protection and on the occasion of his visit the name was changed to Adrianopolis. It was extremely prosperous a century later, its position between Parthia and Rome enabling it to trade with both. Under Caracalla, Palmyra received the fas italica and became a Roman colony. After Caracalla, who succeeded Caracalla, was put to death within a year by the soldiers. A feminine intrigue then seated Helioagabalus, an Oriental priest, on the throne. He was worse, if possible, than Caracalla and his name has become a byword for utter viciousness. After four years he was succeeded by Alexander Severus, who meant well and accomplished much, but the rule of Rome was now become a difficult task. He tried the expedient of paying an annual tribute to the Goths to keep them from molesting the empire. This token of weakness had, as might have been expected, exactly the opposite effect. Severus was murdered by a mutiny in the army (235) and was succeeded by Maximinus who bravely led his army against the Dacians and defeated them, but was assassinated by his own people near Aquilia the next year. Balbinus and Gordian reigned very briefly, though Gordian defeated the Persians under Sapor and the last of the line met his death from Philip the Arab who succeeded him in 244.

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THIRD ESTATE—THIRD-RAIL SYSTEM

losses, saying that so far all who had been Romans. Finally, she had to withdraw within the walls of Palmyra and Aurelia, despite of the handicap of the desert, led in maintaining the siege of the city. Further resistance hopeless, Zenobia attempted to escape, hoping to find in but betrayed by the influence of Roman law she was captured. Then Palmyra capitulated. All the treasures of the city were seized: inhabitants were spared. Zenobia was sent to Rome to grace the conqueror’s triumph, this, instead of being put to death, was given a villa outside of the city of where she lived peacefully, with her son until her death, making many friends the Roman nobility of the time. It is to her taste that is due the construction of the beautiful architectural monuments of Palmyra which have made the city the subject of much interest, while her own life is with romance.

end of the 3d century, after a long of anarchy, was occupied by the firm of Diocletian, a self-made man, the son of parents, who owed his advance to his own genius. He reigned for some 21 years (284-305) and then (see Fourth Century) resigned and retired to a pleasant country not far from Dioclea, his birthplace in Illyria. When the Roman Mid of the city of or the empire which followed his abdications, the abdications of one of his successors, urged to take up the imperial mantle again, he rejected but see the cabbages which in my garden with my own hands, you no longer talk to me of abandoning this spot for the Empire. As might well be said, the man who was capable of this and did give the Roman Empire years of und prosperity, stained unfortunately by persecution of the Christians, but that did not until the beginning of the 4th century under the influence of those who had opposed to him. The 3d century produced no great men, but we have books that have demanded attention ever since. Plotinus (204-270), a well-known Neoplatonic philosopher, studied at Alexandria and afterward philosophy in Rome, wrote his writings in the middle of the century. He was a Platonist, as well as a Platonist and de- the name of Neo-philosopher. His was Porphyry (233-305) wrote a life of 350 and also of Pythagoras, but is best for his treatise "Against the Christians," was answered by Eusebius at the beginning of the 4th century. It is known to us from Jerome’s commentary and other in criticisms. Longinus (210-273), of the essay "On the Sublime" also be the third in length and spent most of his mature the court of Zenobia in Palmyra. He we have said her chief counsellor and her of her children but on the fall of Palmyra he was put to death as a traitor by Emperor Aurelian. Jeph the es- sence of the "Sublime," one of the best pieces of criticism in the Greek language. (See Sublime.) Papinian, the greatest civil of antiquity, and Dio Cassius (155-230), the Greek historian of Rome, both flourished during the first quarter of the century. Dio’s whole work in 80 books was in existence in the 10th century, only some 25 books XXVI to LX now remain nearly complete with but fragments of the others.

PRINCIPAL EVENTS OF THE THIRD CENTURY.

208. Septimius Severus invade Caledonia after conquest and establishment of military government in Britain.

211. Septimius Severus builds wall across Britain to exclude the Northern Picts.

217. Assassination of Caracalla.

222. Heliodorus slays Alexander Severus reigns.

258. Parthian Empire dissolved. Sassanian Persia Empire founded.

260. Death of Dio Cassius, the Greek historian of Rome.


269. Goths invade the Roman Empire, defeat and kill the emperor Decius.

269. The Persians take Valerian prisoner and flay him alive.

261. The Persians capture Antioch.


270. Death of Plotinus, Neoplatonic philosopher, author of the "Enneads."

272. War with Zenobia, queen of the East.

273. Longinus, philosopher and counsellor to Zenobia put to death by Aurelian.

274. Aurelian subdues Zenobia; yields Dara to the Goths.

284. Diocletian and Maximinus joint emperors. The second Roman embassy reaches China.

287. The Celts or Franks settle on the left bank of the Rhine.

292. Galerius and Constantius become co-emperors to Diocletian and Maximinus. The Roman empire divided into four parts.

297. Siege of Alexandria.

JAMES J. WALSH, Author of "The Thirteenth Greatest of Centuries."

THIRD ESTATE. See Tiers-État.

THIRD ORDER. See Tertiaries.

THIRD PARTIES. See Vote, Voters, Voting.

THIRD RAIL. See Electrical Terms.

THIRD-RAIL SYSTEM, in electric railway construction, a method of supplying trains on an electric railway with current sent through a conductor located on the track and termed a third rail. Being the first electric system for handling heavy traffic, it possesses unusual interest. In starting a train of five cars by electricity, from 500 to 1,200 amperes are required.

![Diagram showing typical load carried at power house of Metropolitan Elevated Railway, Chicago, for 24 hours.](image-url)

If such currents were passed through a trolley wheel, very excessive arcing would be caused, due to the fact that the wheel touches the track in a single point. Therefore, the third rail is necessary to carry the current. The diagram shows a typical load carried at a power house of the Metropolitan Elevated Railway, Chicago, for 24 hours.

FIG. 1.—Diagram showing typical load carried at power house of Metropolitan Elevated Railway, Chicago, for 24 hours.
THIRD-RAIL SYSTEM

wire at only one point. The contact surface is not sufficient to carry this current, and burning of the wheel and trolley wire would result. With a sliding shoe, however, instead of a single point of contact, there is a surface about six inches long by two inches wide, and two of these in use at once under normal conditions. The third-rail system differs from the ordinary trolley road only in detail, the principle of operation being similar. These details, however, are such as to make possible the application of electricity to the handling of trains than has been found practicable with the overhead trolley, and the system has thus broadened the field for the application of electricity to railway work, so as to bring it into successful competition with steam for the heaviest classes of service. The reasons for its general adoption on elevated roads were on account of the advantages peculiar to electric traction itself, namely:

1. Reduction in cost of power for handling trains.
2. Increase in passenger handling capacity.
3. A service more attractive to the public generally.

The reduction in the cost of power is obtained largely from the generation of power in a simple central station instead of a great number of smaller plants, as with the steam locomotive system. On this point of economy the fuel bill is one of the large items in the operation of a railroad. With steam locomotives, such as the former used on the Chicago elevated roads, the only fuel available cost in the neighborhood of $3.50 to $5.50 per ton, whereas, in the modern power house, designed for electric railway systems, coal ranging from $1.25 to $1.75 a ton was burned with entire success during the period of low prices for coal. When to this is added the enormous loss in radiation from a large number of steam locomotives, exposed as they are in running over the line of the road, and we compare this with the relatively small loss experienced with a well-constructed stationary boiler plant, it is not surprising that the cost for coal per car mile on the electric railways in Chicago is about one-third the cost per car mile with steam locomotives. The comparison is particularly favorable in Chicago on account of the ability to obtain a very cheap grade of coal directly from the Illinois and Indiana coal fields. In New York and other eastern cities, this difference is not so great, as coal delivered at those points is necessarily higher in price on account of larger freight charges. Besides the saving in the coal bill, there is a further gain by the use of large compound-condensing engine units. The large steam units having a comparatively steady load, develop power with a very much lower steam consumption than the small engines of a locomotive with their constant starting and stopping, and consequent cooling of cylinders, etc. Another item in which a considerable saving is made is in the cost of repairs and renewal of the motor equipment as compared with locomotives.

The second advantage — increase in capacity for handling passengers — is due, first, to the fact that with electric motors a much higher rate of acceleration can be obtained in starting trains, and, second, to the increasing average speed over a given line of road. The trains can also be handled with so much greater accuracy and precision that a much shorter interval is perfectly safe, all of these directly contributing to the end of greater capacity.

The third item — service more attractive to the public generally — is proved by the facts the absence of smoke and steam, and reduction in noise, these being especially important in systems passing through the heart of a large city, as is the case with elevated. In regard to the use of the third-rail system on interurban roads, the same general considerations apply as to the economy of except that trains running less frequently, owing to the generation is not so great. There is another field for the third-electric railway system, which has been developed by the New York, New Haven, Hartford steam road, and that is the light trains for suburban and interurban service on many of their branch lines.

One of the most difficult problems in operating an electric railway system is the tion of the total capacity of a power to the number of cars run, and the subje of this total capacity into proper-sized units. In order to determine these points, it is necessary to be able to estimate the maximum load which will have to be carried during the run and the minimum loads during midday and night. The maximum load does not always depend upon the total number of trains run, some lines more than half of these trains be running light in one direction in order to carry the crowds back on their return. The load on a house operating in connection with an electric railway system varies not only from a minimum during rush hours to a maximum during rush hours, but also momentarily during the day and stopping of trains, these being the most violent when the least

![Fig. 2 — Diagram showing fluctuations in the use of electrical energy on the Metropolitan Elevated Railway, Chicago, at short intervals from 5 a.m. to 11 a.m., ranging from 1,700 to 7,000 amperes.](image)

trains are in service. Under the worst conditions, this rate will vary from 300,000, 4,000 in 15 seconds, or the reverse. It is necessary, therefore, that all parts of the
be especially heavy, particularly the fly-
ner order that sudden changes in the load
interfere with the proper regulation
of engine speed. The accompanying diagram, Fig. 1, shows a
load curve at the power-house. Curve A
shows the train of cars running at the
speed of 100 miles per hour; while Curve C shows a
load with heaters turned on full dur-
rush hours. The high peaks of the
load curve at the rush hours of travel.
second diagram, Fig. 2, shows the vio-
cultations in the demand for electrical
power in the third rail system. The ordin-
ally used for the railroad was largely
of convenience in the first case, as rails
are the easiest form of steel to obtain in rea-
larly, a mile wide. The three rails are ass
mained to the various requirements of
the tracks, angle bars and insulating sup-
port. The value of an ordinary commercial
as an electric conductor, as compared with
tier, is about 10 or 12 to 1, with the
additional disadvantage against the
necessity of the frequent bonding
usually coming in 30-foot lengths.
To his lower carrying capacity, however,
rail at $17 per ton with copper at
r ton, and it can be seen that one can
put a larger amount of steel re-
for a given electrical capacity and still
good margin in favor of the rails. A
rail car carrying about equal to an 800,000 centimeter
able. In purchasing the contact rails for
section of a western railway line, they were
steel of a special chemical composition,
higher electrical carrying capacity than
inary commercial steel rail. The com-
was obtained after a series of experi-
conducted for the Manhattan Railway
York, with a view to getting the best
conductor with a composition of steel
ld be successfully rolled into rails. The
this composition results in a steel rail
as to be unfit for ordinary railway serv-
the conductivity is raised so that, com-
in, copper, the ratio is about 8 to 1,
s 12 to 1 for ordinary commercial steel

**THIRLMERE**

Thirler-meer, England, a long
row lake in the mountains of Cum-
unity, in the centre of the Lake Di-
st of Mount Helvellyn, between Der-
er and Grasmere. It is three miles long
rometer wide. The city of Man-
bought and converted it into a reservoir
water supply, and the system, begun in
completed in 1894 at enormous

**RLWALL**

Thirler-wall, Connop, English
in historians: b. Stepney, Middlesex, 11
7; d. Bath, 27 July 1875. He was edu-
the Charter-house and at Trinity Col-
bridge, where he obtained a Fellow-
fe afterward studied for the law and
led to the bar in 1825. Having ex-
the law for the church he was ordained
some years and after received the
Kirby Underdale, in Yorkshire. Here

he added to his pastoral duties a variety of
literary labors. The first of his works, pub-
lished by himself (his father had previously
issued a number of essays and poems written
by him in extreme youth), was a translation
of Schleiermacher's 'Gospel of Saint Luke,' to
which he prefixed an introduction. This work
appeared anonymously in 1825. His next work
was a translation of the first two volumes of
Niebuhr's 'History of Rome,' with Archdeacon
Hare (1826–31). Then followed the work to
which he chiefly owes his reputation, his 'His-
tory of Greece,' the first edition of which
appeared in Lardner's 'Cabinet Cyclopaedia,'
in eight volumes, between 1835 and 1844. It was
well received, and before the appearance of
Grote's history (the first two volumes of which
were published in 1846) was without a rival in
the English language. Grote himself praises it
for the learning, sagacity and candor it dis-
plays, and said that if it had appeared a few
years earlier he should probably never have
conceived the design of his own work. In 1840
Thirlwall was presented by Lord Melbourne to
the Welsh bishopric of Saint David's, which he
resigned a little more than a year before his
death. He was for a time one of the editors
of the Cambridge 'Philological Museum,' and
during the closing years of his life was a mem-
er of the committee for the revision of the
Old Testament. He was one of the bishops
who spoke and voted for Gladstone's bill for
the disestablishment of the Irish Church.
Consult Perowne, 'Remains, Literary and Theo-
logical, of Connop Thirlwall' (London 1877–
80); Thirlwall, 'Essays, Speeches, and Ser-
mons' (1890); Stanley, 'Thirlwall's Letters to a
Friend' (London 1882); Morgan, 'Four Bi-
ographical Sketches' (1892); Clark, 'Old Friends
at Cambridge and Elsewhere' (1900).

**THIRST**

a craving for water or other
drink. As appetite shows a need for the intro-
duction of food into the system, so thirst is a
sensation indicating the necessity of an in-
creased supply of water. This sensation is
referred to the throat, yet it is not a purely
local feeling, but an index of the wants of the
tissues at large, for thirst cannot be allayed
unless the water swallowed reaches the stom-
ach, is absorbed and carried into the blood.
Thirst may also be relieved by the direct intro-
duction of water into blood-vessels or by rectal
injections of it, or by its absorption through the
skin. How long the demands of thirst may be
suck successfully withstood cannot be stated defi-
nitely, since human beings as well as the lower
animals differ among themselves, and under
varying circumstances of climate, etc., as to the
degree of tolerance. Certain it is that of all
substances a regular supply of water is most
essential to the maintenance of life, and that a
man deprived of it for even 8 or 10 hours, greater in-
convenience, pain and debility are suffered by
an individual than from an equal deprivation of
solid food. As thirst is but the expression of
a dearth of water in the tissues, any condition
which causes a more rapid elimination of water
than usual will increase thirst. Such is the
effect of severe muscular exercise, especially,
for example, the exertion in a heated atmos-
phere habitual with stokers, iron-puddlers, etc.
Thirst is also increased by certain articles of
food, excess of salt or sugar, for example: in
of the ideals we are striving for now we accomplished marvelously in this late medieval century. Generations which themselves lost or impaired their higher interests, are not to condemn this old time. It was great among the "Dark Ages," though we now it to have been in John Fiske's *expresion of the "Bright Ages."

The central interest of the century and greatest triumph was the Gothic cathedrals. In England and France particularly, but a Germany and Italy there arose in the early of the century some of the most beautiful edifices ever built by man. The general architect and engineer were a problem of these huge constructions with absolute success. The decoration of them made a universal appeal and for sheer beauty and suitability never been excelled. The sculpture of the façade of many of these Gothic cathedrals at Amiens, Chartres, Rheims, and Amboise, the greatest plastic work in the history of art. The figure of Christ over the main door at Amiens has been declared the most beautiful production of the human form divine ever seen. Every phase of cathedral architecture contributed to the perfection of its sculpture. The marble work, the hammered iron of the gates and grilles, the very hinges and latches of doors, the brass and bronze work in connect with the altar, the bells, the stained glass, approached perfection so closely that they have been objects of deep admiration ever whenever men have been profoundly interested in the arts and crafts. The stained glass never been excelled and is still an object of most reverential respect, some of it unapproachable in its beauty.

All the fittings and furnishings of the cathedral, even the least obtrusive, partook of same surpassing qualities. Dark corners were not left unfinished for it was the house of God. Every detail was the object of loving devotion. The needlework of the time is probably the best in history. The cope of Ascoli (c1280) is looked upon as the most beautiful ever made. The church vestments and hangings were charmingly worked, in the vestments for the altar were gems of the metal work, of exquisite line and form, delicately finished and appropriately set with jewels. Mass books, as well as the Books of Psalms used by the educated worshippers, were beautifully illuminated that they have marvels ever since and command high prices in the auction rooms. Manifestly, there was nothing that the people of the time wanted do well which they did not accomplish with marvelous perfection. Their domestic and municipal furnishings partook of the same excellency. The very utensils in the kitchen were beautiful as well as useful and the of the two qualities in ordinary life declared the criterion of culture of a people.

The historic life of the century around the cathedrals very much as their life turned around in the cities and towns. Their education came into existence as the result of the development of cathedral schools and these schools placed under the protection of chancellor of the cathedral. The *studia was as the universities were
se they provided education in so different subjects, grew into their form during the courses of the cen-
At the beginning a few cities, Salerno, Bologna and Paris and one or two, had rather important schools of special-
ts around which various faculties gradu-
ted. By the end of the century there were 20 important universities in our sense of the word with large under-
ate departments and as a rule the three ate departments of theology, law and ine. The course of study for under-
estes was summed up by Huxley in his in-
al address as rector of Aberdeen Uni-
t: "I doubt if the curriculum of any n university shows so clear and generous prehension of what is meant by culture is old trivium and quadrivium. The liberal arts, as the trivium and quadrivium also called, constituted the undergraduate stud
ty of grammar, logic and ic, geometry, astronomy, theology and
ty of these subjects were treated from a fic standpoint and these were really fic universities. The study of the classics basis of undergraduate education did not in until the Renaissance time. Hence y's candid admiration for these old-time sities so that he did not hesitate to say their work brought them face to face all the leading aspects of the many-sided of man. The philosophical teaching schools may be explained as the the ideas, form and as the explanation of the sion of matter resembles the modern al chemistry theory that all matter con-
if an underlying substratum the same in is and differentiated into various sub-
s by the dynamic elements which enter . The scholastics taught that matter and could be annihilated by the power that:
them to existence, but not destroyed y human agency, thus anticipating the n world, after a rather long interval of
icity of matter and the conservation ergy. They faced the ethical problems of nd, especially those which concern social ns, exactly in the same spirit which the n world, after a rather long interval of
to recognize human rights as superior to of property, has come around to again, iting on capital and labor for our time Leo XIII quoted the ethics of Saint as Aquinas, drawn up more than six cen-
ter, numbers in attendance at the universi-
: the end of this century were probably in proportion to the population of the s countries than at any time in the his-
f education down to our own day. The cities of Bologna and of Paris had, dur-
the last quarter of the century, more ts than any university of modern times. d and Cambridge were more numerously ed and beginning. Some of sities were boys of 12 or 13 but gradu-
vas earlier than with us as it is still in foreign countries. On the other hand mature students remained at the univer-
s for years. The great lectures were work-
ir up some special theme. The literary of the universities in philosophy and
teology as well as from the graduate depart-
ments generally was extensive. Original work was encouraged, though it was the subject of severe criticism. Groups at various universities were engaged in encyclopedic research and publication. A series of summaries of knowledge in general and of special departments was made.
The discipline of the immense numbers of students represented a problem which was solved by sharing disciplinary regulation with students committees chosen by the Nations, that is, the organizations of the students from particular parts of Europe in attendance at the university. The Nations were fraternal unions which helped the student when he first came to the university to orient himself and get settled for his university work. They protected students against impositions and furnished in-
formation with regard to courses and pro-
fessors. Many of the features of modern life at our universities were thus anticipated. Initia-
tions accompanied by hazing were common practices and the Nations provided recreation of various kinds. On the other hand when students were ailing or when requests for home were delayed by the vicissitudes of the times, help was provided and students were tided over crises in their affairs. A number of abuses crept into university life through these organizations and conflicts between town and gown are noted before the end of the 13th cen-
tury, but it was later in the history of universities that these became so intolerable as to demand correction. In the early history of the universities the study of mediae was a factor at least as the faculty and new univer-
sities were often founded by the withdrawal of dissatisfied students to some other town.
The graduate schools were the most im-
portant departments of the universities. In theology, Saint Thomas of Aquin or Aquinas has been an authority ever since and the contributions which he made to philosophy have been the subject of enduring interest. There was a magnificent development of law through-
out the various countries; the inevitability of the teaching of law. Canon law particularly was taught with a scientific thor-
oughness unequalled before and unsurpassed since. It became the basis of all European law. The medical schools were, however, the special surprise for our time. Early in the century the Emperor Frederick II made a law for the Two Sicilies requiring students of medicine to spend some three years at the university pre-
liminary to their medical studies, and then four years at medicine, followed by a year of prac-
tice with a physician before they were allowed to practise for themselves. That is a modern standard re-established but recently after a long interregnum. Salerno, the most university medical school, set the example in teaching and insisted on the employment of the natural means of cure, fresh air, water, diet, exercise and oc-
cupation and diversion of mind. These are all emphasized in the famous Regimen Sanitatis Salernitanum, issued at Salerno, at the beginning of the century and published in some 300 editions since the invention of printing. It was the most read popular book on medicine for centuries, republished many times even in the last century. It is as it is extant from this time have been a revelation. The surgery of the four masters of Salerno...
who collaborated in the work quite after the modern fashion of textbook writing is surprising in its anticipation of modern surgery. We have, for instance, the book of Theodoric of Lucca and of Bernard of Morondella against William of Salicet, Lanfranc and Mondeville. In these, anasthesia,—through mandrake and opium,—antisepsis by the use of strong wine—they boasted of union by first intention—and as great many of the operations, especially of whole series of intra-abdominal and intracranial operations, as well as many instruments and modes of treatment considered to be modern are described. In the large, very well-planned hospitals of the time, with finely organized nursing, many operations undreamt of in the intervening centuries until our generation were successfully accomplished, not merely as emergency interventions, but to save suffering and prolong life.

The names of the teachers in these graduate schools, Albertus Magnus, Thomas Aquinas, Roger Bacon, Bonaventure, Duns Scotus and Alexander of Hales, are probably better known than any group of teachers in history. In the middle of the 13th century, Walter de Mapleton and the course of science or of medicine had gained repute in recent years with an increase of interest in the medieval period. Albertus Magnus is the only scholar in history whose name the adjective great has become incorporated as if it were a family name. He was a man of the widest interests, intent on testing all knowledge carefully. Humboldt pointed out how much he knew about physical geography, physics, climatology and the physiology of plants. Meyer the historian of botany declared: "No botanist who lived before Albertus could be compared with him unless Theophrastus with whom he was not acquainted, and after him none has studied plants so profoundly until the time of Conrad Gesner and Casalpino." Albert discussed scientifically the Milky Way and its significance, the irregularities in the moon's surface, lunar rainbows, various kinds of refraction and many other problems supposed to be modern. His great pupil Aquinas, adopting Aristotle, laid down the metaphysical principles which are now coming to be recognized as fundamental ideas in the physical and social sciences. Hence a great revival of study of his works. Even more immediately interesting than these to the modern world is Roger Bacon, the international celebration of whose 700th birthday attracted so much attention at Oxford in June 1914. Bacon probably invented gunpowder, suggested that explosives might be used for motor purposes, boats running without oars or sails and carriages without horses,—discussed the theory of lenses, declared that mathematics and experiment were the two important factors for advance in science; anticipated modern ideas as to Biblical revision, insisted on the value of Greek and Hebrew for education, declared that light travels with appreciable velocity and spoke with assurance of aviation. It is clearer than ever now why the people of his time called him "the wonder of the world and the age.

A feature of 13th century education most interesting for our time is the feminine education of the period. At Salerno in southern Italy women were encouraged to study even medicine during the 12th century and the department of women's diseases was in their charge. We have many licenses to practise medicine in the Two Sicilies granted to women at that time still extant. At Bologna at the end of the 12th century the daughters of the great lawyer and law became an instructor in the law school. All of the Italian universities had women teachers on their staff. The unfortunate Héloïse and Abelard incident at Paris seems to have given rise to numerous institutions of education in the universities of the west of Europe, but in Italy the custom established in the 13th century, and there have been women professors at the Italian universities every century since.

The literature of the century is the proof of the intellectual quality of the time, for it was not only great but widely read. Its value will be best recognized from the fact that probably well-read people know the works of the 13th century better than of any other, except their own, though they are often not quite conscious of the fact, not having noted the dates. The enduring work of the time begins with the Arthur legends put into fine literary form by Wolfram von Eschenbach. To him we owe Lancelot. "Like Paris, handsome, and like Hector, brave," but with a fault that makes him even more appealing, so that probably he is the most interesting character of fiction ever created. Then came the ballads of the Cid in Spain, followed by the Nibelungenlied with the Meistersingers and Minnesingers and then the Troubadours and Trouvères with the Romance of the Rose and Renard the Fox in what we call France and, finally, the Trovatori in Italy, culminating in Dante who, the greatest of the Trouvatori, was just ready to write what has often been proclaimed the greatest poem of all literature, as the century closed. Such other writers as Villhardouin, Joinville, Matthew of Paris, the earliest encyclopedists, Vincent of Beauvais, Thomas of Cantimprato, Bartholomew the Englishman, and such works as that of William of Durandus and Jacobus de Voragine of the Golden Legend, are perennially interesting. The century has also the greatest of the Latin hymns, the 'Dies Irae,' the 'Stabat Mater,' the marvelously beautiful religious poetry of Saint Francis himself, of Saint Thomas Aquinas, of Bernard of Morlaix and of Saint Bonaventure.

The century saw the publication of what must be considered the first of encyclopedias, Vincent of Beauvais, under the patronage of Louis IX, with the aid of a great many young assistants of the Dominican Order whose expenses were generously defrayed by the king, was enabled to gather an immense amount of information for his time. In spite of the difficulty of hand transcription, his work extends to over 50 of our volumes octavo. The matter is well chosen and of wide interest, and the surprise is how many things supposed to be much more modern in human knowledge are to be found in Vincent. Pagel declared "the reading admirable teacher."
at excellent observers they were. The
time of these explorers was Marco Polo, immer in a well-trained group of for
and tendency to exaggeration, who
, like Herodotus, to have had a basis
for all that he told. He visited
than kingdom of Abyssinia as well as
d nearly all the world between He-
urmah, of Siam, of Cochin China, of
Java, of Ceylon and India and he had
resting accounts of the coast of Zan-
distant Madagascar and at the oppo-
site the world of Siberia and the shores
rctic Ocean. Colonel Yule, a modern
literature on the literature of travel, can scarcely
is to praise Polo enough. There were
famous travelers whose works have
wnt to us from the century and are
ed in recent years. Friar John of Car-
nmission to the Tatar emperor of
ning north part of the Caspian Sea,
e Jazarkes, along the Dzungarian lakes
ear the Oronon River. illians of Rubruk or Rubruquis, t-
of whose travels was printed by Hak-
is collection of voyages at the end of
century, went even further. Some of
ervations, as for instance on Chinese
are surprising enough, but he has many
Asiatic nature, ethnography, manners,
commercial customs, that were true to
riar Oderic a little later traveled
India and then through China to Nan-
Peking reached the Great Wall en-
het and appears to have visited Lhasa.
Mandeville (15th century) borrowed
om him, as well as from the Premon-
ian monk Hayton. Most of the men
andered in distant lands were gradu-
the universities of the time and while
credulous with regard to what they
evry much as Herodotus himself, they
olutely depended on for informa-
regard to things which they them-
sees the intellectual education which
the cathedral schools and their develop-
t the universities there was a great
popular education along artistic lines
as initiated in the midst of the build-
he cathedrals. Most of the beau-
the great Gothic churches were made
men of the little medieval towns in
hey were built. None of these had
an or few thousand and probably did
age 10,000 inhabitants. Somehow ar-
isans to do all the beautiful work de-
were found and there was the popu-
to appreciate and the diffusion of lib-
cation to patronize and encourage the
of such beautiful things. There are
hills for the payment to village black-
medieval times, the social history of
ark, which we now rank as artistic mas-
Practically all the decorations and
of their cathedrals were executed by
ismen themselves and even their hells
ed glass were made at home, not
from a distance. Transportation tri-
rew them back on themselves and
technical developments while trans-
1 facilities in our time have had an
opposite effect. To secure the making of such
beautiful things there had to be a skilled and
and for the most important factor. Technical training
probably never been a time when the arts and
and crafts, in our modern sense of that term, have
been so appreciated and cultivated. In this
culture the working classes were probably the
most important factor. Technical training
was provided by the guilds. Boys were
prenticed to trades and crafts of various kinds,
and after four or five years of training became
journeymen and traveled from place to place
to learn the secrets and customs of their craft
in the various regions. After two or three
years of this on the presentation and accept-
ance of an example of their work called a
masterpiece — this is where this old English
word comes from — they were admitted as
master workmen into the guild. This repre-
sented a degree in technics. The guild training
was practically a technical school and as the
guilds existed everywhere opportunities for
arts and crafts education abounded. Any
rowing youth who had taste or talent for any
form of artistic work could easily see an
opportunity for its development and then, more
important still, obtain the chance to do his
work in conditions where encouragement and
appreciation would come to him. In England
et the end of the Middle Ages there were 30,000
guilds (Toulmin Smith), the county of Nor-
folk alone having 900, the small town of Wy-
mondham having 11 still known by name. One
of them possessed a guild hall. All the guilds
of the town are said to have been "well en-
dowed with lands and tenements." In Bury
Saint Edwin, Suffolk, there were 23 guilds;
Boston, Lincolnshire, had 14 of which the titles
and particulars are known and London had a
large number. The guild had increased in num-
ber greatly from the 13th century but there is
definite evidence that most of the important
guilds in existence in England at the end of
the 15th century had been in existence for
several hundred years. During this time they
had accumulated very large amounts of money
and invested funds of various kinds. not so
much from the fees paid by their members as
from bequests of various kinds made to them
because it was felt that they were doing great
good work. Unfortunately it was this accumu-
lation of money that led to their legal destruc-
tion, though a few of the London guilds which
were spared in the time of Henry VIII on the
plea that they were trading or secular associa-
tions and not religious organizations have at
the present time an income of over $50,000
per year each. The old guilds were trades
unions, social clubs, insurance societies, civic
organizations, popular entertainment commit-
tees, but withal religious sodalities enforcing
fulfilment of religious duties yet not permitting
the clergy to hold office or dominate policy.
The social history of the time is its most
interesting feature for our era. The begin-
ing of the period saw the rise of the two great
mendicant orders, the Begging Friars, the Fran-
ciscans and Dominicans. A world so deeply
intent on commerce as to give rise to Hansa
and the great Italian commercial cities that
afforded the example of two large bodies of
men who took voluntary poverty for their lot
so as to be free to do better things in life.
The coming of the Friars in such an age produced a deep impression. Saint Francis is one of the most lovely persons of all history. A young man who, during convalescence from a severe illness, learns in Dean Stanley's words that "the world looks very different when viewed from the horizontal," gets up from it, resolved that the fascination of trifles shall not obscure the good things of life. He proceeded to forget all about himself and his personal interests and found that all the world began to think of him. He got so close to the heart of nature that it is not surprising that we have legends that the birds and the fishes, and even the wolf of Gubbio barked to him. He gathered around him a group of men forever famous for their absolute simplicity of life and for their refusal to let selfish motives rule them in any way. Such a life might seem too ideal to have any practical influence over mankind, and, above all, too mystical to make any appeal except to a mediæval world, yet literally dozens of lives of Saint Francis have been written in our very busy practical age. Probably no other saint of our own time has there been so many people, and above all so many whose opinion is of value, ready to proclaim Saint Francis one of the most wonderful characters of humanity as in our era of crowded interests. The love for Lady Poverty of the "little poor man of God," as he loved to call himself, has appealed to all religious and poetic souls ever since. No wonder that Dante has made such a brave figure of him in the Divine Comedy, and placed beside him as equal in influence and power the great founder of the Dominicans.

The development of hospitals in the 13th century has been the subject of much study in the modern time. Virchow particularly has shown that there was probably scarcely a town of 5,000 inhabitants or more in Germany which did not have a hospital. He attributes this great development, more marked even in other countries than in Germany, to Pope Innocent III who founded the hospital of the Santo Spirito by the old bridge across the Tiber and addressed it as the future center of a universal humanitarian organization. Pope Innocent summoned Guy of Montpellier to Rome, having heard that he was in charge of the best organized hospital of the time, built Santo Spirito under his direction, and then when bishops came to Rome, as they had at regular intervals, he commended the hospital of Santo Spirito to their study and recommended, where it was virtually a command, that there should be a hospital as far as possible like that, according to the conditions in each locality, in every diocese in the world. Many of these hospitals were beautifully built. Municipalities constructed them for their citizens and they were public buildings, part of the scheme of the city beautiful which so many mediæval cities cherished. In smaller places hospitals were often built by the nobility and Virchow has called attention to the number of them constructed under the patronage of the family to which Saint Elizabeth of Hungary belonged. The love for Mary, as Madam de Variationen in her book on the beautiful church erected in honor of a few years after her death now stands, was a model for others. The hospital in Siena, added to (14th century) in memory of Saint Catharine, was another centre of charitable influence. The sister of Saint Louis of France was the mistress of an hospital at Tonnerre, which Viollet le Duc figured in his Dictionary of Architecture. It shows how well these hospitals solved problems of hospital construction which have vexed us again in the modern time. They was a fine organization of nurseries in hospitals under the care of religious orders men and women, especially the Augustins. How well their work was done can be best appreciated from the great development of surgery which took place at this time, for no surgery is impossible without good hospital and good nursing. Portions of many of the hospitals remain as evidence for what they were.

With a notable development of social service during the century and the opportunities afforded for feminine education, it is not surprising that the names of a series of women this time are well known, indeed their press has been growing constantly in this last generation, just in proportion as similar opportunities for men developed. The women of Hungary is probably the most famous, the beautiful cathedral erected in her honor Marburg within a few years after her death, one of the handsomest monuments ever raised to a woman, and the testimony of her general to their affectionate regard for the dear Saint Elizabeth (Frau Heilige Elisabeth) they quaintly called her because she was a wife and the mother of four children, though she died at 24, had found time to do great work for the poor around Queen Blanche of Castile, the mother of S. Louis of France, was another wonderful one of the time. Her great son attributed all he was to his mother's training. She was a wise administrator of high ability who fitted her out of a period of threatened anarchy to serve his kingdom for her boy, and yet deep that she would rather see him dead at feet than know that he had committed a sin. The great women of the time came not only on thrones but also among the classes. Another mother of the time whose name is recalled in veneration was the of a London tradesman, Mabel Rich, a son, Saint Edmund of Canterbury, one of most sterling characters of the time, a churchman, made archbishop, went into rather than submit to a tyrant king. Edmund tells how the poor around his mother's home London blessed her for her charity and quite frank that he owed nearly everything life her. Another distinguishes English woman whose name has come down to us this time is Isabella, the famous Countess Arundel. She did not hesitate to admit even the king himself, Henry III, when he visited the liberties of England. Mme Paris says that with a dignity which was than that of woman she reminded the that many times he had, extorted money to his subjects and not kept his word and rights of Englishmen then done, the king was violating them. With this interest in Saint Francis there has been a parallel rebirth of admiration for Saint G of Assisi who at the age of 17 left him have Saint Francis teach her how to live.
could not be wasted in worldliness. Her sons, however, had pursued her voca-
original, joined her in the second order
iscians in a few years.

military and political events of the cen-
tury a special significance because as a rule influ-
ence still lives. The Crusades came to a
the fourth under Boniface, Marquis
(1222), the fifth led by King
II (1228), the sixth (1248) and the
last (1270), under Louis IX
of the Children’s Crusade (1212) was the
in the Crusades went beyond reason. Most of the many
of children crusaders perished or
were sold into slavery by design-
In 1230 the Teutonic Knights in a
against the pagan tribes of the Baltic
established themselves in Prussia and
the foundation of what at the Reforma-
rough the ambition of a grand master,
become a duchy, the beginning of mod-
austria. In 1282, Rudolph of Hapsburg,
.noble, elected emperor in the first elec-
tion of a form of the Imperial Elec-
the creation of seven electors, con-
on his sons the duchies of Austria and
: foundation of the Hapsburg dynasty.
ing the century the kings of Aragon
xtended their sway over the Spanish
isla and the Balearic Islands (1230).
he Sicilian Vespers, a massacre of the
in Sicily by the Sicilians, so-called from
mentace at vespers on Easter Monday the
ngers conquered Sicily passed to them,
years before (1265) the French
House of Anjou had ascended the
of the Two Sicilies. In 1235 the duchy
swick was formed under the House of

Five centuries afterward, when reign-

favour, the Guelfs were to succeed to
one of England (George I) where they
on. The century saw the rise of Flor-
importance, the decline of the republic
, the increase of Venice in power under
ocracy which became hereditary toward
of the Franchi and the enthronement
ers at Bologna. The closing year of
Pope Boniface VIII proclaimed the
the and the crowds who flocked to Rome
rate it were so large that they could not
bridge to the Vatican until the rule
road of keeping to the right was pro-
the first time in history there is men-
it.
where political events were occurring to
far-reaching significance. Edward I
and to whom the contest between
Baliol for the crown of Scot-
d been referred as umpire, conferred it
iel on condition that he should receive
assal of England. The Scotch refused
the and the enfranchisement
which Magnus of Norway (1266) had
Hebrides, felt its nationality at stake,
dethroned and fled to Edward who
ed to enforce his rights. William Wal-
 famous hero of Scottish popular
led an insurrection that was joined by
iam Douglas and Robert Bruce who
round them most of the Scots. They
Edward at Falkirk (1299),
ert Bruce was proclaimed king and suc-
ceeded in maintaining himself until the defeat
of Edward II at the great battle of Bannock-
burn (1306) settled him firmly on the throne.
The foundation of the Ottoman or Turkish
Empire (1299) under Othman I in Bithynia
led to the consolidation of Mohammedan power
the serious disturbance of Europe. The
Turks are historically regarded as the Mongols
who had already created the splendid empire
of the Seljuks and who from the 11th to the
13th century governed the greater part of the
caliphs’ dominions in Asia and thus prepared the
way for the Ottomans, their successors. The
nucleus of their empire was formed in Asia
Minor toward the end of the century under
Er
dogruhl. Osman or Othman or Ottoman, his
son, is looked upon as the founder of the
empire.

The century saw the career of the best ruler
of all time, Louis IX of France, or Saint Louis
as he came to be called. It has been said of
him, “Of all the rulers of men of whom we
have record in history, he probably did his
duties the most seriously with most regard for
others and least for himself and his family.”

The watchword of his rule was justice, though
he made it the aim of his life that men should
have justice and education, and when for any
misfortune they needed it—charity. For an
unjust judge there was short shrift. The old
tree at Versailles under which he used to hear
the causes of the poor who appealed to him
stood for many centuries the living reminder
of Louis’ efforts to make the dispensing of justice
equal to all men. Voltaire, unsympathetic in
so many ways, said of him, “Louis IX appeared
to be a prince destined to reform Europe if
she could have been reformed, to render France
triumphant and civilized and to be in all things
a pattern for men. A far-reaching policy was
combined with strict justice and he is perhaps
the only sovereign who is entitled to this praise;
prudent and firm in counsel, intrepid without
 rashness in his wars, he was so compassionate
as if he had always been unhappy. No man
could have carried virtue further.”

Guizot, the French statesman and historian, so little
appealed to by the medieval, said “The world has
seen more profound politicians on the throne,
greater generals, men of more mighty and
brilliant intellect, princes that have exercised more
powerful influence over later generations; but
it has never seen such a king as this Saint
Louis, never seen a man possessing sovereign
power and yet not contracting the vices and
passions which attend it, displaying upon the
throne in such a high degree every human vir-
tue, purified and ennobled by Christian faith.
He was an ideal man, king and Christian, an
isolated figure without any peer among his suc-
cessors or contemporaries.” His reign is the
history of France for nearly 50 years (1226-70).
He influenced not alone France but the other
peoples of his time deeply. He was chosen as
the umpire in disputes in foreign countries.

Louis’ instructions to his son, so emphatic
of justice as the great law among men, his
deep interest in education, his foundation of the
Sorbonne, his beneficence to the University of
Paris, his encouragement of art and architecture,
La Sainte Chapelle is his monument, as
well as his scholarly patronage of men of letters
in friendly intercourse, all stamp him as one of
the most broad-minded of men.
Two great Spanish monarchs deserve to be remembered beside Saint Louis. They are Ferdinand (1208-52), the saint, king of Castile and Leon, whose mother, Berengaria, was the sister of Blanche of Castile, the mother of Saint Louis. To him is due the collection of translations in the vernacular of the Forum Iudicum of the local municipal courts. He was one of the oldest speciments of Castilian prose extant and the foundation of Spanish jurisprudence. His son, Alfonso X (1221-84) the Wise, is also known as the astronomer because of the Alfon-sine tables, a series of astronomical observations compiled by his direction, but better known as the author of the code Las Siete Partidas, the basis of modern Spanish law. Ticknor ('History of Spanish Literature') declared that Alfonso "first made Castilian a national language by causing the Bible to be translated into it and by requiring it to be used in all legal proceedings." Under these two great monarchs, Spanish literature began its magnificent career, and the ballads of the Cid and of Bernardo del Carpio became the common property of the people.

Surprisingly enough one phase of political history outside of Europe in the century is as important as anything in Europe. Genghis Khan founded the Mongol or Mongol Empire. He was a Tartar (Tatar) chieftain, by name, Temuchin, who on the death of his father succeeded to the Mongol throne at the age of 13 (1175). The chief who owed him allegiance were turbulent and restless, and had been restrained by the iron rule of his father. They refused to submit to a mere boy, but Temuchin's mother had the courage and vigor to repress many of them and keep them to their allegiance until Temuchin showed before long that he could rule them himself. He soon extended his sway over neighboring chiefs and in 1206 proclaimed himself emperor, invaded northern China and securing firm footing within the Great Wall soon conquered most of the country. He then turned westward, defeated the Mongomedans who had heaved his envoy, overwhelming an immense army of nearly half a million, of whom 100,000 were left dead on the field. Pressing westward he besieged Bokhara, captured Arta, and good Merv, all of which were sacked and burned. Astrakan was taken, the Russians defeated and Great Bulgaria ravaged. His troops conquered more of India and most of China, so that this one-time chief of a petty Mongol tribe "lived to see his armies victorious from the China Sea to the banks of the Dnieper; and though the empire which he created ultimately dwindled away in the hands of his degenerate descendants, leaving as a wreck behind, we have in the presence of the Turks in Europe a consequence of his rule, since it was the advance of his armies which drove their Osmanli ancestors from their original home in northern Asia and thus led to their invasion of Byzantium under Osman and finally their advance into Europe under Ammirath I.*

Representative government developed during the century parallel with other achievements. Magna Charta was signed in 1215; the constitutional rights of the upper classes were also granted to all free men of our kindred, for us and for our heirs forever; all the underwritten liberties to be had and held by them and their heirs of us and our heirs forever. Whatever the reason, this eventually a grant to all free Englishmen in 1257. The Provisions of Oxford of Henry III established the stated reelection of the House of Commons. The great national council of Parliament, the Knights of the Shire, and the representatives of the twelve great lords who formed the House of Commons were admitted to government, while those personally summoned by the king from the nobles were called the House of Lords. Beginning under Edward I, the attendance of members became regular, making Parliaments really representative of the country. At the same time, Bracton's 'Digest of the English Common Law' (1262) secured the basis of law down to our own time. English-speaking countries.

Nothing of all this accomplishment of century probably possesses livelier interest for us than our commercial history. During the century, trade combinations and municipal trade combinations and municipal preferences, which were so important to different peoples, were rendered even more easily. Some of the more important developments of international intercourse anticipated. Miss Zimmer ('The Ha-League,' Stories of the Nations Series)

"There is scarcely a more remarkable development in history than that which deals with the balance of power, in the alliance or association known as the Hansa League. The league has long since died away, having served its time and final purpose. The needs and circumstances of trade have changed and new methods and instruments have been devised for carrying on the commerce of the world. Yet, if the Hansa League has disappeared, the beneficial results of its action survive to Europe, though they have come so completely a part of our present-day life that we accept them as matters of course. We do not stop to inquire into their origin.

The condition of the great mass of people as the result of the growth of genuine wealth in this period is particularly interesting for our time. We have people everywhere the happiest century of human life. More men and women than probably other time enjoyed the blessedness of finding their work and that work being sufficiently remunerative, because it represented an interest of mind or soul rather than the body. Power and the art impulse were not spread, and triumphs of arts and science were made even in very small towns. Those without special talent the name.

Thurid Rogers, in his 'Economic Institutions of History,' says: 'On the whole were none of those extremes of poverty which have excited the astonishment of philanthropists and the indignation of men. The age, it is true, had its disadvantages, but of poverty that perishes under the will to work and opportunity, there was little or none. Wages were very low, accorded standards, but a broad agreement between wages and prices in the consideration. The social improvement
THIRTY-NINE ARTICLES—THIRTY YEARS’ WAR

THE 13TH CENTURY led to the fixing by the 13th century led to the fixing by the 13th century led to the fixing by the 13th century led to the fixing by the 13th century led to the fixing by in the time of Edward III in the early morning of the 13th century. An act of Parliament dated 14th century names beef, pork, mutton, and the food of the poorer sort. Hol- lere frequent. Besides the Sundays there were 35 holy days during the year on no work was done, and Saturday after- noon free after the vespers hour, 2 P.M., the vigils of all first-class feasts, h O’Grady declared this abundance of the source of the greatness of the time. In the world’s history, in the 5th cen- tury for a time, in Greece and then into the 13th century A.D., we spent one-third of their time in leisure preparation for and in celebration of mysteries. In both periods they had and the energy to create artistic and tual monuments which the world will willingly let die.

AL EVENTS OF THE THIRTEENTH CENTURY.

4th Crusade led by Boniface, Marquis of lef, on the conquest of Normandy. Constantinople is besieged taken by the French and Venetians. Baldwin, ict of Flanders, elected emperor of the East. Sea- battle of the Greeks as the Mongol emperor. The Mongol emperor begins his career conquest, extending his expeditions from China to Europe. Innocent III lays an interdict on England. The Persian Crusade. The Inquisition instituted at Avignon to check heresy. Feat of the Saracens at Tolosa. Spain. Contest between the Moors and Christians arouses the spirit of the Goths divide into three kingdoms, Castile, Leon, and Portugal. The ill-starred Children’s War. Liberties of Oxford University confirmed by papal bull. Venerable revolt against the king of England. John I of England forced to sign Magna Carta. Rise of trade and labor unions becomes independent. Golden period of commerce. Cities of Venice, Genoa and Pisa furnish ships to Crusades. Architecture, fine arts and the indulge-flourish throughout western Europe. Six months before his coronation as St. Louis the second, Pope of France. Saint Francis of Assisi, founder of Franciscan Order, dies. 4th of Genus Khan. Fifth Crusade led by King Andrew II. Thirteen knights establish themselves in Brazil. 8th of Elizabeth of Hungary dies. 9th of the last Crusade. "The Irrefragable Doctor" of theology, dies. 10th of Louis IX of France leads the Sixth Crusade. 11th of Ferdinand the Saint, King of Castile and Leon. 12th of the Jews are expelled from France. 13th of Israel. Palaeologus founds a family of distinguished emperors. 14th of Constantineople from Western domination. 15th of Barons’ War in England. John de Baliol founds Balil College, Oxford. 16th of Beaune, the encyclopedia of the Middle Ages. 17th of the 13th century reigns. Deputies of Commons first summoned to Parliament. The long of the Two Sicilies comes under French domination. 18th of the Mongol-Tatar invasion of China. 19th of the last Crusade. Death of Saint Louis anec. 20th of Polo’s travels extend the knowledge of the 1st crowned king of England. 21st of Thomas Aquinas, "Prince of Scholastics," 1280. Albertus Magnus, the "Doctor Universalis" of German philosophy, dies. 1280. The Mongol-Tatars conquer China, overthrow the Southern Sung dynasty and establish the dynasty of Yuan. Under Kublai Khan, grandson of Genghis, the grand canal of China is dug. 1282. The Sicilian Vespers, Massacre of the French in Sicily. Conquest of Wales by the English. 1284. Death of Alfonso X, the Wise, of Spain. 1285. Philip IV reigns in France. 1290. The Jews are expelled from England. 1294. Roger Bacon, the "Doctor Admirabilis" of English science, dies. 1297. The English Parliament is organized. 1297. Edward I takes the coronation chair and the records of Scotland to London. 1299. Scotch defeat at Falkirk. The Ottoman or Turkish Empire founded. JAMES J. WALSH, Author of "The Thirteenth Century and Its Days." THIRTY-NINE ARTICLES, The. See ARTICLES, THE THIRTY-NINE. THIRTY TYRANTS, (1) a body of Athenian aristocrats, headed by Critias and Thrasymenus, who undertook to administer the affairs of Athens at the close of the Peloponnesian War, 404 B.C. They put to death their opponents, and set a Spartan garrison in the Acropolis. Later Thrasymenus led the exiled citizens against Athens, defeated the Spartan forces of the Thirty, and slew Critias. Democratic government was restored and soon afterward recognized by Sparta. (2) The Thirty Tyrants of Rome were a band of revolutionists who tried to secure the imperial power during the reigns of Valerian and Gallienus (qq.v.).

THIRTY YEARS’ WAR, so called because it lasted from 1618 to 1648, was at first a struggle between Protestants and Roman Catholics, north Germany supporting the former, and southern Germany, with Austria at its head, the latter cause. It gave the Swedes an opportunity to extend their dominion south of the Baltic, it reduced the resources and weakened the power of Austria, and it gained for the northern states of Germany the breathing space needed to develop independent existence. Few wars, however, have been more calamitous in their general effect on the mass of the people and the happiness and progress of mankind. Apart from the horrors which attended the capture of Magdeburg, and other barbarous scenes of the struggle, it reduced the peace and prosperity of the townsmen and made the townsmen to abject misery; it may be said to have effaced for a time literature and art in Germany, and it magnified the system of petty principalities, since partly effaced as a result of the Napoleonic wars, but still a powerful obstacle in the way of complete German progress.

On the one side were Austria, nearly all the Roman Catholic princes of Germany, and Spain; on the other side were, at different times, the Protestant powers and France. The occasion of this war is to be found in the fact that Germany had been distracted ever since the Reforma- tion by the mutual jealousy of Roman Catholics, Lutherans and Calvinists, which led the Protestant princes to form the Evangelical Union in 1608, against which the Roman Catholic League was formed the following year. Certain concessions had been made to the Protestants of Bohemia by the Emperor Rudolf II (1609), but these were withdrawn by his successor Matthias in 1614, and four years afterward the Bohemian Protestants were in rebellion. Thus began the first part of the long
war, the part that is known as the Bohemian War. The Protestant Bohemians were led by the Union, and an auxiliary corps into Bohemia, under the command of the brave Ernst, count of Mansfeld. Their leaders were driven by the imperial troops from Bohemia, invaded the archduchy of Austria, and advanced to the gates of Vienna, but their failure to conquer and win over the greater part of the Protestant Bohemians since the religious peace of 1552 were to be restored to the Church, the Calvinists were to be expelled from the benefits of that peace. This or which threatened to take a large number of bishops and almost all the abbey and ecclesiastical foundations of north Germany of the hands of those who then held the all Protestant Germany with alarm and longed the war. Many princes and refused to obey it, and the emperor was in order to give effect to it, to keep his in the field. But these forces did not main the command of Walle in a meeting of the princes of war in August 1630, Ferdinand found it easy to yield to the general demand for I tion, and the supreme command of the armies was given to Tilly, who then marched against Magdeburg, which had to carry out the edict.

In the meantime a new hellerant as on the scene, one whose exploits interested episode of the whole was was Gustavus Adolphus, king of Sweden landed on the coast of Pomerania on 1630. The inducements which led him himself up with the struggle were the protecting Protestantism in Germany, establishing the power of Sweden on of the Baltic and that of checking the power of Austria in north Germany, this last year he had the secret su French minister Richelieu, who was of the growing power of the house of Sweden Adolphus was generally by the inhabitants of the Protestant Germany as their deliverer, but the princes did not extend to him so eager a come. Fearing the revenge of the emperor for the most part refused his offered and at the diet of Leipzig resolved to a neutral attitude. The old Duke of Pomerania whose territory had been terribly devast imperial troops, had at once opened to him, but the electors of Branden Saxony refused him a passage through their territories, and while the time was in negotiations the town of Magdeburg repeated assaults, was taken and destroyed in May 1631. Tilly now threatened the elector, John George I, hasten to his own defense, the alliance he refused in the interests of Prussia. On 17 September (O. S. 7 Sept the forces of Tilly and Gustavus Adolphus at Breitenfeld to July 1631, the former were completely defeated, and treated to the south while the Sweden advanced to the Main and Rhine. By the end of winter the latter had made his supporter of the 1631 Christian of Denmark received back all the territories belonging to him that had been occupied and devastated by the imperial troops, on the condition of promising to interfere no more affairs of Germany.

Austria went on more victorious; but her greater victory the more complete war the triumph of the Roman Catholic Church. With this object the emperor issued the of Restoration, in virtue of which all the religious foundations and other church that had been favorable to the Protestantion since the religious peace of 1552 were to be restored to the Church, and the Calvinists were to be expelled from the benefits of that peace. This order threatened to take a large number of bishops and almost all the abbey and ecclesiastical foundations of north Germany of the hands of those who then held the all Protestant Germany with alarm and longed the war. Many princes and refused to obey it, and the emperor was in order to give effect to it, to keep his in the field. But these forces did not main the command of Walle in a meeting of the princes of war in August 1630, Ferdinand found it easy to yield to the general demand for instruction, and the supreme command of the armies was given to Tilly, who then marched against Magdeburg, which had to carry out the edict.

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on the banks of which Tilly had taken strong position. On 15 April 1632 this was forced by the Swedes and Tilly mortally wounded during the engagement. placed in the path of Gustav Adolphus, accompanied by the former Palatine, Frederic V, advanced as far nich, the Bavarian capital. Meantime emperor had in his distress again turned to store and induced him by treaties the concessions to undertake to levy and command a new army. After a successful operation against the Saxons, Wallenstein joined the troops in Bohemia and marched with into Franconia, where the Swedes had themselves strongly not far from Nuremberg. On arriving there Wallenstein took their strong position in the neighborhood fortified a camp. Here the two armies lay against each other without coming ched battle and the attempt to evict the resources of the neighborhood were ended and resolved to venture upon an attack against the enemy’s camp. But in spite of the of the assailants, the attack, again and again defeated, was hired by the forces of Gustavus adolphus, was obliged to give up the hope of his attempt and soon after he led his forces to Saxony. Thither Wallenstein followed, and on 16 Nov. (O. S. 6 Nov.) 1632, was fought at Lützen, near Leipzig, in Wallenstein was defeated, but in which he the Swedes lost their king and leader. The death of Gustavus Adolphus the in of the war was assumed by the Chancellor Axel Oxenstierna, who, in this capacity, got the Protestant princes and of the Franconian, Swabian and the two circles of the Germanic empire to in the Heilbronn Convention to uphold the edes until the victory of the Protestant forces should be secure. The principal generals elected under him were Bernhard von der and the Swedish general Horn. France supplied the money. Bavaria was laid by the Swedes, who since the death of carrying on the war in as barbarous and as the intention of penetrating now ed in Silesia. In this province and in a Wallenstein lingered without exhibiting the energy that was demanded of the imperial court. This slackness, to with the circumstances, caused him to the notion of entering into treasonable negotiations with the enemy, and Ferdinand ultimately deposed him and placed him under the the empire, in consequence of which he ordered by some of his own officers (25, 34). After this the imperial army moved Bavaria, and on 6 Sept. 1634, gained a victory over Bernhard von Weimar dillingen. Several German princes, the of whom was the Elector of Saxony, never being well inclined to the Swedes, thought it convenient to conclude separate with the emperor, and the people of the region to cherish the hope of soon seeing the end of the war. The separate peace between the peace of Prague, was concluded 30 May 1635, and in it Sweden obtained some of Lusatia as a hereditary possession, and the emperor virtually gave up the restitution.

The hopes raised among the people of Germany by this and other separate peace were far from being confirmed. Germany itself was almost unanimous in desiring peace, but the Swedes thought it to their interest to go on with the war in order not to lose the advantages they had gained, and France now determined to take a more active part in the war, with the view of abolishing the house of Hapsburg and extending the French boundaries to the Rhine. Richelieu promised to the Swedes important aid in money and troops, and the war was renewed with greater vigor than had been shown since the death of Gustavus Adolphus. The Swedish generals Baner conquered and rendered desolate Saxony and Thuringia (1636); Bernhard von Weimar took Rheinfelden, Freiburg and Breisach (1638), and formed the scheme of creating for himself an independent principality on both banks of the Rhine, but was stopped short in his career by death in 1639. In the midst of these events the emperor had died (February 1637), and had been followed by his son Ferdinand III, a man of milder and less energetic temper than his father, but as firmly attached to the Catholic faith, and equally inclined to force it on his subjects.

In the autumn of 1640 the new emperor assembled a diet at Ratisbon to deliberate over the best method of conducting the war, and while this council was sitting, Baner, who had for the last few years been constantly engaged in the east of Germany, conceived the audacious plan of leaving his winter quarters and taking the whole council, along with the emperor, prisoners (January 1641). A sudden thaw prevented the execution of this scheme by melting the ice on which he had hoped to cross the rivers. Baner died during the retreat. He was succeeded in the command of the Swedish army by Torstenson, the ablest of the generals who proceeded from the school of Gustavus Adolphus. Although generally confined by the gout to a sedan chair, he astonished the world by the rapidity of his movements. He vanquished the imperial armies near Leipzig (Breitenfeld 1642), advanced into Moravia with the intention of penetrating further, attacking the emperor in his capital, but suddenly appeared in Schleswig and Holstein and put to flight Christian IV of Denmark, who had lately allied himself with the emperor and brought an army into the field (1643). Later (August 1645), Wrangel, another Swedish general, forced Christian to accept a disadvantageous peace. After his victory over Christian IV, Torstenson again turned south, and having destroyed two imperial armies, one under Gallas and the other under Hatzfeld and Götz, in conjunction with Rakoczy, prince of Transylvania, once more, threatened Vienna (1645). But the emperor was again delivered from the danger. The withdrawal of Rakoczy obliged Torstenson to give up his design; and in the following year, worn out by illness, he resigned his command, which was taken up by Wrangel. Meantime the French had been operating on the Rhine and in the west of Germany. After the death of Bernhard von Weimar they had taken widower of Luxemburg as a hereditary possessor, and the emperor virtually gave up the restitution.

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in great part destroyed. He himself was mortally wounded soon after. In the following year neither of the French generals Enghien and Turenne was able to gain any considerable advantage; but on 3 Aug. 1645, the Austrian general Gallas was invested near Nördlingen, after which the junction of the French and Swedes was inevitable. Late in the summer of 1646 their united armies advanced through Swabia and Bavaria, and in the armistice of Ulm (March 1647) compelled Maximilian of Bavaria to fall away from the emperor. In the following year further successes were gained and Wrangel was on the point of uniting his forces with those of the other Swedish general Königsmark who had penetrated into Bohemia, when the news reached the armies that the Peace of Westphalia, which had been negotiating for five years at Munster and Osnabrück, was concluded. By a singular coincidence it happened that the last blow of the war was struck at the place where the war originated, Prague. Königsmark had taken one part of the town and was preparing to attack the other when he was stopped by the news of peace. See Austri—ENGLAND—GERMANY—GERMAN LANGUAGE AND LITERATURE—GERMANY—GERMAN CATHOLICS; GUSTAVUS II ADOLPHUS—SPAIN; SWEDEN; WALLSTEIN.

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THISBE. See PYRAMUS AND THISBE.

THISTLE, a composite plant of the genera Carduus, Cirsium, Centaurea, Onopordon or Onos. Other related plants are the golden thistle or Spanish oyster-plant (Scylolus hispanicus) whose roots are used as a vegetable like salisly and parsnip, which they resemble somewhat closely in flavor; globe-thistles (Echinops), often planted in shrubberies and borders as ornaments for their striking effect; blessed thistle (Cnicus benedictus) a hardy annual herb useful for rockeries and wild gardens, but commonly regarded as a weed in the Mediterranean region where it is native, and in California where it has escaped cultivation; and the milk-thistle, called blessed or holy thistle (see SILPHIA), often grown in European gardens for its edible roots, leaves and heads and also for its ornamental qualities. Several plants of other families have sometimes been called thistle from their apparent resemblance to true thistles. The best known of these are probably the blue thistle (Echinum vulgare) of the Mediterranean, and the fuller's or clothier's teasel (Dipsacus fullonum) and its few related species of the family Dipsacaceae.

Among the best known genera the following species are probably most widely recognized. The Scotch or cotton thistle (Onopordum acanthium) is a biennial occasionally grown in America. It is sometimes found in the Eastern States. It has cottony white spiny foliage and large solitary terminal heads of pale purple flowers. The plants are often six feet tall and are planted in front of dark colored shrubbery. They seem unlikely to prove troublesome as weeds in America. Some of its other popular names are Queen Mary's, silver, Argentinian, ass' and down thistle. The Scottish thistle seems more likely to be really the stemless thistle (Cirsium aculeolatum) which is common in land. The so-called Canada thistle (C. arvense) is a native of Europe and Asia, widely naturalized in North America, and a troublesome weed in fields where cultivation and rotation are faulty, as both by its seeds and its perennial root-stocks, every fragment of which is capable of propagating a new plant. Pink leaf formation by persistent cultivation is a serious remedy as well as a safeguard. It is a slender herb about three feet tall and numerous small purplish pink flowers. The bull thistle (C. lanulatum) and the thistle (C. horridulum) are also well known and are found along roadsides in especially pastures. The pasture thistle (C. odoratum) is found in cultivation. The star thistle (Centaurea calcitrapa) bears a resemblance to the blessed thistle. Several related species, notably the corn blue bottle, bachelor's button or blue cyclamen) and the dusty miller (C. incana) popular garden plants. Three species of thistles—the Scotch (S. scoticum), the field (S. arvense) and the spiny (S. asper)—are well-known weeds in the United States and the Carlene thistle (C. vulgari) plays a similar role upon poor soil in Europe. The last was so named because tradition says that Charlemagne used them medicinally.

THISTLE, Order of the. See ROYAL.

THISTLE-BIRD, the American go (q.v.).

THISTLE CROWN, the name of a coin of James VI of Scotland, of the value 97.3 cents. It bore on the obverse a rose on the reverse a thistle, both crowned.

THISTLEWOOD, Arthur, Esq.; born at Tufthorns, near London, 1 May 1820. He is said to have been a habituated anarchist and to have been arrested on the way from Paimie and from a visit to France in the fall of Robespiere. He entered the 1798 and rose to the rank of a lieutenant in various regiments, both natural and of gambling and dissipation, he became an active member of the society formed by Spence, which aimed at revolutionizing social institutions. He attempted to organize an revolution in 1816 which failed. He then went to France and there met with little success in the efforts of informers, and in 1817 was arrested for treason, but escaped conviction. In 1841 he suffered a year's imprisonment for treason, but escaped conviction. In 1841 he suffered a year's imprisonment for treason, but escaped conviction. In 1841 he suffered a year's imprisonment for treason, but escaped conviction. In 1841 he suffered a year's imprisonment for treason, but escaped conviction. In 1841 he suffered a year's imprisonment for treason, but escaped conviction. In 1841 he suffered a year's imprisonment for treason, but escaped conviction. In 1841 he suffered a year's imprisonment for treason, but escaped conviction. In 1841 he suffered a year's imprisonment for treason, but escaped conviction. In 1841 he suffered a year's imprisonment for treason, but escaped conviction. In 1841 he suffered a year's imprisonment for treason, but escaped conviction. In 1841 he suffered a year's imprisonment for treason, but escaped conviction. In 1841 he suffered a year's imprisonment for treason, but escaped conviction. In 1841 he suffered a year's imprisonment for treason, but escaped conviction. In 1841 he suffered a year's imprisonment for treason, but escaped conviction. In 1841 he suffered a year's imprisonment for treason, but escaped conviction. In 1841 he suffered a year's imprisonment for treason, but escaped conviction. In 1841 he suffered a year's imprisonment for treason, but escaped conviction. In 1841 he suffered a year's imprisonment for treason, but escaped conviction.
ho was ostensibly one of the conspirators he deepest in Thistlewood's confidence. His education had just as they were to proceed to the execution of their pur- 3 Feb. 1820. Being tried and condemned raitor, Thistlewood, with four of his co-
rs, was hanged and decapitated.

ISTLEWOOD CONSPIRACY. See TREAT CONSPIRACY; THISTLEWOOD, ARTHUR.

IVIE, theôrè. See THIBIERS, GREECE.

OBURN, Isabella, American missionary loucator: b. near Saint Clairsville, Ohio, 1840; d. Lucknow, India, 1 Sept. 1901. One of Scotch-Irish parentage. She was ed in the Wheeling Female Seminary, mented by a year in the study of art at Cincinnati Academy of Design. After
ng in the public schools for several years, ent a year as an instructor in a private at New Castle, Pa., and, in 1866, became tress of the Western Reserve Seminary st Farmington, Ohio. In 1869, at the or-
tinent, she received the degree of M. D. by the Methodist Episcopal Church, as selected as its first missionary, being ed to work in India, whither her brother, M. Thoburn (q.v.), had gone 10 years . In April 1870, she organized a school tive girls at Lucknow with but six pupils erself as the only teacher. She also en- evangelistic, Sunday school and zemana. The grade of the school thus established rapidly raised as its attendance increased. a full high school course was offered. in response to a demand for still more ad- l courses of instruction, classes in the collegiate grades were offered in 1887 n 1895, after having complied with the requirements of the British Indian gov-
ent, it was granted a charter as the Luck-
Woman's College. Climatic conditions, seriously impaired her health, necess-
several extended furloughs, the years 2, 1890-90 and 1890-90 being spent in ca, though they were years filled with y in behalf of the cause to which her lite ven devoted. The name of the Lucknow n's College was subsequently changed to f. Isabella Thoburn Woman's College. It Thoburn, Bishop J. M., 'Life of Is-
thoburn.'

OBURN, James Mills, American dist Episcopalian bishop: b. Saint Clairsville, Ohio, 7 March 1836. He was graduated eghney College, Meadville, Pa., in 1857, son after entering the ministry. In 1859 s ent as a missionary to India and until when he retired, was identified with work in region. He was elected bishop of India alasia in 1888 and was for six years the of the Indian Episcopalian Church. His writings in 'Missionary Addresses' (1887); 'India alasia' (1893); 'The Deaconess and Vocation' (1893); 'Christless Nations'; 'The Church of Pentecost' (1901); isabella Thoburn' (1903) and 'The lan Conquest of India.'

OBURN, Joseph, American soldier: rickergus, Ireland, 20 April 1825; d. Creek, 19 Oct. 1864. In August follow-
s parents emigrated to America, settling arm in Belmont County, Ohio. His edu-

cation was obtained in the primitive rural schools of the period, supplemented by diligent private study. He became a teacher in the public schools at the age of 17 and later, having advanced to the principalship of a village school, he began the study of medicine. He was graduated from Starling Medical College, Columbus, Ohio, in 1850. After a year as an interne in hospital service, he located for the practice of his profession at Wheel-
ing, (West) Va. At the outbreak of the Civil War he was commissioned surgeon of the first regiment raised in Virginia for the Union service. At the battle of Philippi, its colonel (Benjamin F. Kelley) was seriously wounded and, the other field officers not being available for duty, the command of the regiment dev-
ved upon the surgeon, who continued to act in that capacity until the expiration of its 100-
day term of service. When the regiment re-
enlisted for three years he was commissioned as its colonel. After a year of service as a regimental commander, he was assigned to the command of the Fourth Brigade, Fifredi-
y of the Methodist Episcopal Church, as selected as its first missionary, being ed to work in India, whither her brother, M. Thoburn (q.v.), had gone 10 years . In April 1870, she organized a school tive girls at Lucknow with but six pupils erself as the only teacher. She also en- evangelistic, Sunday school and zemana. The grade of the school thus established rapidly raised as its attendance increased. a full high school course was offered. in response to a demand for still more ad- l courses of instruction, classes in the collegiate grades were offered in 1887 n 1895, after having complied with the requirements of the British Indian gov-
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s parents emigrated to America, settling arm in Belmont County, Ohio. His edu-

THOBURN, Joseph Bradford, American writer: b. Bellaire, Ohio, 8 Aug. 1866. In 1871 his parents removed to Marion County, Kan., where he was reared on a farm and at-
tended the public schools. He learned the printer's trade and did some newspaper work, after which he entered the Kansas Agricultural College from which he was graduated in 1893. In 1899 he removed to Oklahoma City, where he engaged in newspaper work. He served as secretary of the Oklahoma Territorial Board of Agriculture from December 1902 until July 1905. Since 1907 he has devoted himself largely to the work of research and writing along the lines of local and western history.
From 1913 to 1917 he was connected with the University of Oklahoma as a specialist in research, field-work and collections in local history. During this time he did considerable work in the way of excavating prehistoric earth-works, cave dwellings, tumuli, etc., in Oklahoma. In the course of these investigations he secured positive evidence that the natural mounds, so-called, which are so often pointed out as remains of an immediately west of the lower half of the valley of the Mississippi, the origin of which had long been a subject of dispute among scientists, are of human origin, each tumulus, so far as examined, proving to be the mound of a timber-framed, dassenhaard, earth-covered human habitation. He has been in the service of the Oklahoma Historical Society since July 1917, being engaged in research, field collections and editorial work. He is the author of a comprehensive history of Oklahoma, published in 1916.

THOLEN, tō’lən, Netherlands, an island in the province of Zeeland, north of the Ooster Schelde and 21 miles northwest of Antwerp, contains 47 square miles. It is protected by dykes, of which the principal products are wheat, rye, barley, oats, flax, madder, beans and potatoes. Tholen is also the name of the chief town. Pop. 3,254.

THOM, tōm, James, Scottish sculptor: b. Ayrshire, Scotland, 1799; d. New York, 17 April 1850. He was by trade a stonemason and suddenly leaped into notice by his group "Tam o’ Shanter and Souter Johnny," cut in the sandstone on which he was accustomed to work. This group now forms part of the Burns monument at Doon, near Ayr. It was first exhibited in Edinburgh (1828) and by its success the sculptor was led to move to London, but in 1837 sailed for the United States, where his genius found at last a liberal recognition. Among his best known works is "Old Mortality," now in Laurel Hill Cemetery, Philadelphia, of which he was induced to make many replicas.

THOMA, tō’ma, Ludwig, German satiric novelist and dramatist: b. Oberammergau, 21 Jan. 1867. He attended gymnasium at Munich and Landshut, the Forestry School at Aschaffenburg in order to study law, the universities of Munich and Erlangen, thus obtaining his entire education in Bavaria. For a short time he practised law at Dachau, later at Munich (1897-98), soon relinquishing this career for that of literature. The general tone of his literary work is well indicated by the fact that he has been connected with the humorous and oppositional weekly Simplicissimus (q.v.) at Munich, as editor, since 1899. März, a more serious periodical (bi-monthly), has also for a time been under his editorship. The cartoons and quips of Simplicissimus were one of the mainstays of the German liberals in their fight with the Imperial Government, and it was one of the great disappointments of 1914 to behold the paper assume a more and more chauvinistic attitude after the events of August in that year, supporting the predatory and imperialistic policy of the German government where resistance would have been the proper attitude of a liberal organ. Thoma’s own attitude was similar to that of the great wave of chauvinism which the government had efficiently launched, he took part in the patriotic shouting, and incidentally engaged in polemic correspondence with a number of American writers, including GEORGE HAYE, Putnam, who published some of their interchanges of views in a book. But Thoma is too critical and subtle a man to become a chauvinist of the worst type. His literary work, his opposition is directed against petty social prejudices and, in the political field, to the Roman Catholic Church; in the latter respect he resembles AUERBACHER, and ROSENGGERER (q.v.), both of whom, like THOMA, bitterly attack the abuses of the papacy, not from a Protestant standpoint, but from the usual hostile position of the Roman Catholic countries. The most notable sat on the clergy are the short story "Der heilige Hieß" (Munich 1904), and the bitter novel Drews Vöst (ib. 1905, 13th ed., 1910). Three best plays, which are very popular on German stages, are "Die Lokaalbank," a com (1902), "Morals," comedy (1909), and "Magdalen," a popular tragedy ("Volkstuck," 1908). Each has as its theme one of theacies of provincial life. "Die Lokaalbank" pictures the career of a group of government officials, who never achieve any real "Morals" reveals the low morality of a group of persons who have joined a society for the uplift in order to be the more effective cloaked from each other; "Magdalen" is story of a girl's gradual shifting from the life that is frank and unselfish, and who therefore, meets with no disapproval from villagers, to one that is governed by considerations of money, thus causing her ostracism and death. No man has better depicted the life the small peasant and country townsman, Bavaria than has Thoma.


THOMAS, Saint, also called DIDO (Tomus being the Aramaic, Didymos Greek word signifying "twin"); of one of the Twelve Apostles known as THE DONO such a twin brother of a sister Lysias, children Diophanes and Rhoa. This Thomas is said to have been a native of Antioch, twin brother of a sister Lysias, children Diophanes and Rhoa. Eusebius implies that he was a stepbrother of Jesus and that his real name was Judas. The scene in the Gospel in which the doubts were raised as to whether Thomas had expressed with enthusiasm as to the fact of the resurrection is the chief of the three occasions on which he is prominent (consul to John xx., 24-29; Let xxiv, 1-11); in which the doubts were raised as to whether Thomas had expressed with enthusiasm as to the fact of the resurrection is the chief of the three occasions on which he is prominent (consul to John xx., 24-29; Let xxiv, 1-11); in which the doubts were raised as to whether Thomas had expressed with enthusiasm as to the fact of the resurrection is the chief of the three occasions on which he is prominent (consul to John xx., 24-29; Let xxiv, 1-11); in which the doubts were raised as to whether Thomas had expressed with enthusiasm as to the fact of the resurrection is the chief of the three occasions on which he is prominent (consul to John xx., 24-29; Let xxiv, 1-11);
Thomas, Augustus, American playwright: b. Saint Louis, Mo., 8 Jan. 1859. He was a special writer and illustrator on Saint Louis, Kansas City and New York newspapers, and became editor and proprietor of the Kansas City Mirror in 1889. He soon left the field of journalism and became a playwright. He is the author of the popular dramas, 'Arizona,' 'In Mizzoura,' 'The Burglar,' 'The Man Upstairs,' 'On the Quiet,' 'The Earl of Pawtucket,' 'The Other Girl,' 'Mrs. Leffingwell's His Boots,' 'The Education of Mr. Pipp,' 'Jim Delancy,' 'The Embassy Ball,' 'The Witching Hour,' 'The Harvest Moon,' 'As a Man Thinks,' 'Indian Summer,' 'That Overcoat,' 'The Hoosier Doctor,' 'The Rio Grande,' 'The Copperhead,' etc. He is a member of the American Academy of Arts and Letters, and of the National Institute of Arts and Letters, of which he became president in 1914, and from which he received a gold medal for his services to the drama. In 1914 he received the degree of A.M. from Williams College.

Thomas, Becket. See Becket, Thomas.

Thomas, Calvin, American college professor: b. near Lapeer, Mich., 28 Oct. 1854; d. New York, 4 Nov. 1919. He was graduated at the University of Michigan in 1874, taking his A.B. degree the same year and the degree of LL.D. in 1904. He taught Latin and Greek at the Grand Rapids High School for a while, after which he studied philology at Leipzig in 1877-78. Following this course he devoted himself to the teaching of German, and was professor of that language at Columbia University. He edited a number of the standard German classics for school and college use and wrote extensively on philological subjects for educational and literary publications, besides assisting in the compilation of the New Standard Dictionary. In 1909 he edited an 'Anthology of German literature.'

Thomas, Charles Spaulding, American lawyer and politician: b. Darien, Ga., Dec. 6, 1849. He removed his family to Michigan in his youth, and was educated in the State university, taking his LL.D. there 1871. He practised law in Colorado, and was chairman of the Democratic national convention in 1880. From 1899-1901 he was governor of Colorado, and in 1913 was chosen United States Senator to fill the unexpired term of Charles J. Hughes, deceased. He was re-elected for the term 1913-21.

Thomas, Cyrus, American archaeologist and entomologist: b. Kingsport, Tenn., 27 July 1825; d. 1910. He was admitted to the bar in
1851 and practised law for several years, finally entering the Lutheran ministry in 1864. He was naturalist on the United States Geological Survey, 1869-74, and professor of natural sciences in the Southern Illinois Normal University, 1874-77. He was State entomologist of Illinois 1875-82, and in 1882 he became ethnologist in the United States bureau of ethnology in Washington, D.C., on account of his explorations. Of special interest in this latter line are his 'Studies of the Manuscript Troano' (1882); 'Notes on Certain Maya and Mexican Manuscripts' (1884); 'Mound Exploration' (1888); 'Prehistoric Works East of the Rocky Mountains'; 'Indians of North America in Historic Times' (with W. J. McGee 1903).

THOMAS, Edith Matilda, American poet: b. Chatham, Ohio, 12 Aug., 1854. She was educated at the State Normal School, Geneva, Ohio. Much of her verse is distinctly above the average, displaying not only very subtle feeling, but great delicacy of expression. She contributed to many periodicals and published in book form 'A New Year's Masque, etc.' (1885); 'The Round Year' (1886); 'Lyrics and Legends' (1890); 'Fair Shadow Land' (1893); 'In Sunshine Land' (1895); 'In the Young World' (1895); 'A Winter Swallow and Other Verse' (1896); 'The Dancers' (1903); 'Cassian and Other Verses' (1910); 'The Great at the Gates' (verse, 1909); 'The White Messenger'; 'The Flower from the Ashes' (1915).

THOMAS, George Henry, American soldier: b. Southampton County, Va., 31 July 1816; d. San Francisco, Cal., 28 March 1897. On his father's side he was of Welsh and English ancestry. His mother was of Huguenot descent. He received this early education at Southampton Academy, near his home, and soon after his graduation was appointed to a cadetship at the West Point Military Academy, by the Hon. John Y. Mason, member of Congress from the Southampton district. He was graduated at West Point in 1840, standing 12th in a class of 42 members, W. T. Sherman being sixth. He was a thoughtful and industrious student at the academy, a characteristic which followed him throughout his later military career. In 1840 he was appointed lieutenant in the Third artillery. He served in the war against the Seminoles in Florida, and later in the Mexican War, and was brevetted captain and major for meritorious services. at Monterey and Buena Vista. He was instructor at the Military Academy in 1851-54. In 1852 he was united in marriage with Miss Frances Kellogg of Troy, N. Y. He was commissioned major of the 5th cavalry not long after he joined, and for some years saw duty on the western frontier, and engaged in campaigning against hostile Indians.

Upon the breaking out of the Civil War he rejoined the cause of the Union, and was appointed brigadier-general of United States Volunteers. It has been stated that early in 1864, during the period of suspense and uncertainty that preceded the war, he was wavering in his loyalty to the government, and that he applied to the President for his release from the army. No evidence on this point exists. He was early made major-general of volunteers and was placed in command of the first division of the Union army in Kentucky. On May 1862, he won the first important victory by the government forces in the west, defeating the Confederates under G. Z. Biddle, at the battle of Mill Springs, Kentucky, and was promoted to the rank of major-general of volunteers and thanked President Lincoln in a complimentary address for the victory. At the battle of Stone River (q.v.), near Murfreesboro, his command repelled the enemy, reinforced the Union line, where he gave additional evide of his abilities as a commander, and of his qualities as a fighter. At the battle of Tamaqua (q.v.), in September 1863, commanded the 14th corps composed of divisions of Rector's army, and at the end of the engagement on 20 September he held the left of the general line, and successfully resisted the repeated attacks of the Confederates. About noon the right wing of the army was weakened by the withdrawal of troops to meet Thomas' left flank, and the assaults of Hood and Longstreet. The right of the army was routed, but Thomas reformed his troops on the Snodgrass Hill, and with the reinforcements brought forward by Gen. Gordon Granger, and other detachments, checked the onslaught of the victorious Confederates, repelled their repeated attacks, held the position until nightfall, when he withdrew his forces to Rossville. His defeat at Snodgrass Hill was one of the most ominous events and one of the darkest struggles of the Civil War. He fairly wore the title of the "Rock of Chickamauga," by which he is so well known.

In the engagement of November 1863, at the front of Chattanooga (q.v.), General Thomas, with the 1st corps, stormed the heights of Missionary Ridge and drove General Bragg's army from its strong position on the crest, gaining a complete victory over the Confederates. In the campaign against Atlanta (q.v.) in 1864 Thomas was second in command under Sherman, and ably co-operated with that soldier in accomplishing the brilliant series of successes achieved by the Union army. General Sherman left Atlanta and marched his army through Georgia to the sea. Gen. Thomas took command of the Federal forces remaining in Georgia, Alabama and the Carolinas and prepared to meet the Confederates under General Hood, then threatening the advance into Tennessee. General Thomas began the concentration of his forces in Nashville (q.v.). His troops under Schofield stayed Hood's advance at Nashville, and inflicted terrible losses on the Confederates, but Hood soon appeared at Nashville and threatened to attack. General Thomas was soon transferred to Vicksburg, and placed in charge of Smith's command from Missouri. He was forced by cavalry under Gen. J. H. S. M. He was forced by cavalry under Gen. J. H. Stoneman's command from Missouri. The time was needed for equipping the cavalry, organizing the troops. Severe winter had set in, and the troops were covered with ice and sleet — thus the military operations. Meantime the army at Washington became impatient at.
dered Thomas to attack Hood. General as explained and remonstrated, and took me by these results, fully seduced his fore they could be executed he attacked s army and gained one of the most com- und brilliant victories of the war, routing m dispersing Hood's forces. General as, the close of the war he was in command Department of the Cumberland at Nash- and was most useful in reorganizing and uing the civil laws and government in ssee and the adjacent States. His high a character, executive ability and good ent were instrumental in establishing and good order throughout that section. 1. Thomas must be credited with a very order of military ability, and a most hon- place in the history of the Civil War. 2. no serious military mistakes, and can ured with no defeats.

After the closing of the war he was as- to the command of the Military Division Pacifc, with headquarters at San Fran- where he died. His wife survived him few years. They had no children. Con- oppee, Henry, 'Life of General Thomas' York 1893); Bradford, Gamaliel, 'Union its' (Boston 1916); Van Horne, T. B., of Major-General G. H. Thomas' (New 1882).

OMAS, George Housman, English utor and engraver: b. 7 Dec. 1824; d. ne, France, 21 July 1868. He began life apprentice to a wood engraver, and prac- hat art in Paris, but gave the greater part time to book illustration, in which he very proficient. He lived in the United in 1846-47, and made designs for 'Mansion'. After his return to England he became ian on the 'Illustrated London News'. otabe pictures are 'The Queen Giving 1 to Crimean Heroes,' and 'The Queen rince Albert at Aldershot.'

OMAS, Isaiah, American printer and ilder: b. Boston, 19 Jan. 1749; d. Worces- April 1831. He was apprenticed to aiah Fowkes, a Boston printer, with whom published the 'Massachusetts Spy,' of which n became sole proprietor. So bold were hig-editorials that in 1771 he was sum- to appear for alleged sedition. He re- and the attorney-general, when ordered secute, failed to obtain a bill of indict- rom the grand jury. After participation skirmish at Lexington, he continued the tion of the 'Spy' at Worcester, where it ter appeared with the exception of a brief in 1770-71. In 1788 he opened a book- Boston, with branches in various parts United States. Among his publications Massachusetts Magazine (8 vols. s); a folio Bible (1791); and several edit- of 'Pennsylvania.' He was under (1812), first president, and most patron of the American Antiquarian. He published a 'History of Printing,' which contains much valuable mate- rial. This was reprinted in 1874 by the Anti- quarian Society. Consult Lincoln, 'History of Worcester' (1837); Hill, 'History of Isaiah Thomas' (Boston 1874); Hill (in Antiquarian Society 'Transactions,' Vols. IX and X, Worcester 1909).

THOMAS, Jesse Burgess, American Baptist clergyman: b. Edwardsville, Ill., 29 July 1832; d. June 1915. He was graduated from Kenyon College in 1850, and practised law in Chicago 1857-62. He was pastor of the First Baptist Church, Brooklyn, 1864-69, of the Michigan Avenue Baptist Church, Chicago, 1869-74, and from 1874-88 was pastor of the First Church, San Francisco. From 1888 he was professor of church history at the Newton Theological Seminary. He published 'The Old Bible and the New Science'; 'The Mould of Doctrine,' etc.

THOMAS, John, American physician and soldier: b. Marshfield, Mass., 1725; d. Chambly, province of Quebec, 22 June 1776. He was sent as surgeon to the army in Nova Scotia in 1746; was on the medical staff of General Shirley's regiment in 1747; but secured an appointment as lieutenant in 1759. In 1760, while commanding a regiment under Amherst, he was engaged in operations against the French at Lake Champlain and at Montreal. He was a delegate to the Massachusetts provincial con- gress 1774-75 and having, during the Revolution raised a regiment of volunteers, was appointed brigadier-general. He took part in the siege of Boston; forced the British to evacuate Dor- chester; and participated in the Canadian campaign.

THOMAS, John Jacob, American writer on agricultural topics and authority on horticulture: b. near Lake Cayuga, 1810; d. 1895. He became widely known for editorial work and was a recognized authority on farm topics. His best known publication is 'The American Fruit Culturist' (1845), the twenty-first edition of which was reprinted in 1899. He also issued a book on 'Farm Implements and Machinery' (1869) and a work on the 'Rutabaga' (9 vols., 1855-81); writings greatly valued in his day.

THOMAS, Joseph, American lexicographer: b. Cayuga County, N. Y., 23 Sept. 1811; d. Philadelphia, 24 Dec. 1891. He was educated at Rensselaer Polytechnic Institute, Troy, N. Y., and at Yale, was graduated in medicine at Philadelphia, and engaged in practice there. He was in India in 1857-58, where he made a study of Oriental languages and later spent four months in Egypt in the study of Arabic. He was subsequently professor of Latin and Greek at Haverford College, Pennsylvania. He was associate editor with Thomas Baldwin of 'A Pronouncing Gazetteer' (1845), which was revised and published as 'A Complete Pronouncing Geographical Dictionary of the World' (1855); 'A New and Complete Gazetteer of the United States' (1854), etc. He also wrote 'A First Book of Etymology' (1851-52); 'Travels in Egypt and Palestine' (1853); 'A Comprehensive Medical Dictionary' (1864; rev. ed., 1886); 'Universal Pronouncing Dictionary of Biography and Mythology' (1870-71; 3d ed., rev., 1905); and other works.
He contributed the pronouncing vocabulary of proper names to 'Webster's Unabridged Dictionary.'

**THOMAS, Kempis.** See KEMPIS, THOMAS A.

**THOMAS, Lorenzo,** American soldier; b. Newcastle, Del., 26 Oct. 1804; d. Washington, D. C., 2 March 1875. He was graduated from the United States Military Academy in 1823. At the organization of the Adjutant-Generals Department he received a major's commission and served as chief of staff of the army in Florida (1839-40) and in the same capacity on the staff of General Butler during the Mexican War. In 1861 he became brigadier-general of the army and was retired from active service in 1869. He was named Secretary of War by President Johnson in 1868, but did not take office because of the refusal of Stanton to vacate.

**THOMAS, Martha Carey,** American woman educator and writer; b. Baltimore, Ohio, 2 Apr. 1857. She was educated at Cornell University, where she was graduated in 1877; studied in Johns Hopkins and Leipzig and took the Ph.D. degree at the University of Zurich in 1883. The Western University of Pennsylvania and Brown University have conferred upon her the honorary degree of LL.D. She taught English branches in Bryan Mawr College of which she was chosen president in 1895. She also was elected a trustee of Cornell University. She has published 'Sir Gawayne and the Green Knight' (1885); 'The Education of Women' (1900), and many articles on the higher education of women contributed to standard magazines. Mrs. Mary Garret, a benefactress of Bryan Mawr, left her for educational uses $15,000,000.

**THOMAS, Seth,** American manufacturer; b. Plymouth Hollow (now Thomson, Conn.), 1 Dec. 1816; d. there, 28 April 1888. He was the son of Seth Thomas (1780-1859), in whose honor Thomson was named and who began the manufacture of metal-movement clocks. The younger Thomas assumed the business, introducing his clocks throughout the world. He manufactured all sorts of timepieces.

**THOMAS, Theodore,** American musician; b. Esens, East Friesland, 11 Oct. 1835; d. Chicago, Ill., 4 Jan. 1905. He played the violin in public at the age of six and when only 10 made his first public appearance in New York. In his early concert and operatic engagements he appeared with Jenny Lind, Sontag, Grist and Mario. During 1855-69 he was associated with Mosenthal, Bergmann, Matzka, Berger and William Mason in successive seasons of chamber-music concerts. In 1864, having organized the orchestra which long went under his name, he began his symphony concerts in New York. These were continued, excepting the interval from 1869 to 1872, until 1878, when he went to Cincinnati to become director of the College of Music. With an orchestra, sometimes of 40 and later enlarged to 60 pieces, he visited the large cities of the East and West, giving concerts of both popular and classical music and always given to the development of musical taste. With his name were associated the biennial musical festivals held in Cincinnati from 1873 to 1898. Festivals of similar character were held under his direction in Chicago in 1882 and 1884 and in New York in 1882. As early as 1862 he was appointed conductor of the Brooklyn Philharmonic Society; when the New York Philharmonic Society was organized he was chosen its leader, and both positions he retained until 1891 when he made his residence in Chicago and became leader of the permanent orchestra in that city. In 1893 he was appointed musical director of the World's Columbian Exposition. Consult Thomas, Rose Fay, 'Mountain Garden' (New York 1904; new ed. 1915) and Upton, G. F. (editor), 'Theodore Thomas: A Musical Autobiography' (2 vols. Chicago 1905).

**THOMAS, Theodore Gaillard,** American physician; b. Edisto Island, S. C., 21 Nov. 1831. He was educated at Charleston College and was graduated as a physician in 1854. Speedily moving to New York where he served in Bellevue Hospital and became professor of diseases of women in The College of Physicians and Surgeons. He also was surgeon in the Women's Hospital and consulting physician to the Children's Hospital and Hospital of Brooklyn. He was a distinguished gynecologist and president of the American Society of Gynecologists; honorary member of the London Obstetrical Society and correspon
ding secretary of the Obstetrical Society of Berlin. He performed the first ovariotomy in the United States and published an account of it in 1870. His work on the Dis
cases of Women (Philadelphia 1868) ran in six editions and was translated into the modern languages, including the Chinese.

**THOMAS, William Henry Griffith,** English theologian; b. England, 1861. He was educated at King's College, London, and Christ Church, Oxford, and was ordained a priest of the Church of England in 1885. From 1890 to 1905 he was vicar of Saint Paul's, Londo
principal of Wyckcliffe Hall, Oxford, 1905-9 and was appointed professor of Old Testament the
ology at Wyckcliffe College, Toronto, 1910. He is author of Methods of Biblical Study (1902); A Commentary on Genesis (1906-07); 'The Power of Prayer' (1906); Christianity in Christ' (1909); 'A Commentary on Romans' (3 vols., 1911-12); 'Work and the Ministry' (1911); 'The Prayers of St. Paul' (1914), etc.

**THOMAS, William Widgery,** American Ambassador; b. Portland, Me., 26 Aug. 1807. He was graduated at Bowdoin College in 1829 and in 1862 became bearer of dispatches for the government of the United States. He served in Turkey; became vice-consul-general at Constantinople and subsequently was appointed acting consul at Galatz, Moldavia, a war-consul at Gothenburg, Sweden. In 1862 he resigned and in the following year was a sworn to the Maine bar. In 1869 Mr. Thomas was made commissioner of public lands for the State of Maine and in 1870-73 served as such. He was ambassador to Sweden, returning to America, where he was appointed minister to Sweden, and in 1889-94 and 1897-1905 served as consul in Norway and in 1889-94 and 1897-1905 served as envoy extraordinary and minister plenipotentiary to Sweden and Norway. In 1873-75...
improved methods of study into various departments of learning and as a jurist took a firm stand against trial by torture and witchcraft. He wrote 'History of Wisdom and Folly' (3 vols., 1693); 'Thoughts and Reminiscences' (1723–26); and other important works. Consult works concerning him by Luden (1865); Wagner (Berlin, 1872); Nicoladini (ib. 1888); Kayser (Hamburg 1900); also White, A. D., 'Seven Great Statesmen in the Warfare of Humanity with Unreason' (New York 1910).

THOMAS, W. Va., city, situated in the northwestern part of the state, on the Kanawha River, 12 miles southwest of Charleston. It is a manufacturing center, and is noted for its coal, timber, and iron deposits. It is served by the Chesapeake and Ohio Railroad. The population was 2,826 in 1930.

THOMAS, Gottfried, German theologian and writer, b. Egenhausen, Württemberg, 1802; d. 1875. He was educated at Halle and Berlin and occupied the chair of theology at Erlangen University from 1842 until he died. He is author of 'Origines' (1837); 'Christi Person und Werke' (1852-61; 3d ed., 1889-88); 'Christlichen Dogmengeschichte' (1874-76; 2d ed., 1886-89) and various similar works. Consult von Stahlin, 'Löhe, Thomasius, Harless' (Leipzig 1887).

THOMASTON, Conn., town, in Litchfield County, on the New York, New Haven and Hartford Railroad, 10 miles north of Waterbury, on the Naugatuck River. It was built up by the noted clockmaker, Seth Thomas, who removed there in 1813 and established his business. The great clock for Independence Hall, Philadelphia, was made there in 1876. The town has clock and watch factories, a brass rolling mill and cutlery manufactures. Pop. about 4,500.

THOMASVILLE, tōm'əs-vil, Ga., town and county-seat of Thomas County, on the Atlantic, Birmingham and Atlantic, the Florida Central and the Atlantic Coast Line railroads; about 10 miles from the Georgia boundary and 35 miles south of Albany. It is in an agricultural and stock-raising region. The chief industrial establishments are cotton compresses, cigar factories and creameries. There is a large trade in cotton, pine, tobacco, wool, fruit, vegetables and grain. A branch of the State University, called the South Georgia Agricultural and Mechanical College, is located here. Other educational institutions are the Young Men's College for Women, founded in 1869, and the Vashon Industrial School for girls, supported by the Woman's Home Missionary Society of the Methodist Episcopal Church, South; a normal school for negroes; the graded schools and a public library. Thomasville was settled in the 19th century and received its present charter in 1889. Pop. 6,727.

THOMASVILLE, N. C., city in Davison County on the Southern and the Carolina and Yadkin railroads, 22 miles southeast of Greensboro. A Baptist orphanage is located here. The city has cotton mills, machine shops and furniture and woodworking factories and is growing. Pop. about 4,000.

THOMISM, tōm'izəm, one of the two great schools of scholasticism, the other being Scotism (q.v.). It derived its name from its founder, Saint Thomas Aquinas, the great Dominican doctor; while Thomism and Scotism are both scholastic in their fundamentals they differ in various conclusions and corollaries chiefly as follows: (1) on the nature of universals; (2) the principle of individuation; (3) the manner...
in which grace acts on the human will; (4) the proof of immortality of the soul; (5) freedom from original sin in the case of the mother of Christ; (6) the effects of the merits of the Incarnation; (7) certain points on the mode of the efficacy of the sacraments; (8) whether an action may be morally indifferent; (9) on the question of toleration. See AUGUSTAS, Thomas.

THOMPSON, Augustus Charles, American Congregational clergyman: b. Goshen, Conn., 30 April 1812; d. 1901. He was educated at Yale University, at Hartford Theological Seminary and at the University of Berlin. His ordination as a Congregational pastor at Roxbury, Mass., took place 27 July 1842. With the Rev. Dr. Rufus Anderson he visited India in 1854 with a deputation from the American Board of Missions and was delegate to the London Missionary Conference in 1858. He lectured at Andover Theological Seminary (1877-80), at Boston University (1882) and at Hartford Theological Seminary (1885-86). He is author of numerous memoirs including those of Mrs. A. J. Waters (1856) and Rev. Dr. A. W. Anderson (1880). His larger publications include 'Moravian Missions' (1882); 'Foreign Missions' (1889); 'Protestant Missions' (1894), and 'The Eielor Memorial' (1900). He also published translations in the Marathi and Tamil tongues.

THOMPSON, Benjamin, Count RUMFORD, American physicist: b. North Woburn, Mass., 26 March 1753; d. Auteuil, near Paris, 21 Aug. 1814. He entered a Salem counting-house in 1760, later was made major of New Hampshire militia, and became a wealthy man, but, charged with being a Tory, fled to Boston, where he was associated with the British officers. He went to England in 1776 as bearer of certain dispatches, and as a reward for his services obtained a situation in the Foreign Office under Lord George Germain. He became Under-Secretary for the Colonies in 1780, and was shortly afterward appointed lieutenant-colonel of the King's American dragoons. Returning to England in 1783, he retired to Harvard. In 1784 he was knighted and went to the Continent. Through the recommendation of the Prince of Zweibrücken (afterward king of Bavaria) various writers of knighthood, was made a lieutenant-general and created count of the Holy Roman Empire, choosing the title Count Rumford from the name of his wife's native town (now Concord, N. H.). He left Bavaria in 1795, and returned to England, where he employed himself in making experiments on the nature and application of heat and on other subjects of economical and philosophical research. He clearly recognized that heat is a mode of motion, and that by a given amount of mechanical work a definite amount of heat may be produced. Among the objects which engaged his attention was the search for a remedy for smoke chimneys, which at that time formed one of the greatest nuisances in the country; and he succeeded in discovering the principles upon which fireplaces and chimneys have since been constructed. He likewise suggested the plan and assisted in the formation of the Royal Institution, which led to other establishments of a similar description. In 1801 he removed to Paris, where he took up his residence, and, his wife being dead, he married the widow of the celebrated Laplace; but the union proved unfortunate and a separation was long took place. Count Rumford then retired to a country house at Auteuil, about four miles from Paris, and there devoted his time to the embellishment of his domain and to the cultivation of chemistry and experimental philosophy. His investigations respecting the strength of materials and the force of gunpowder led to considerable improvements in artillery, and he also made discoveries in connection with light and illumination. Count Rumford was also a means of extensive learning, but he was familiar with the discoveries and improvements of contemporary science, and the industry and perseverance with which he pursued his inquiries enabled him to make several additions to the knowledge of chemistry and practical philosophy. He was the founder and first recipient of the Rumford medal of the Royal Society, and also founder of the Rumford medal of the American Academy of Arts and Sciences, and of the Rumford professorship in Harvard University. His complete works, with a memoir by George F. Ellis, were published by the American Academy of Arts and Sciences (Boston 1870-75). Consult also Slosson, E. E., in 'Leading American Men of Science' (ed. by D. S. Jordan, New York 1910).

THOMPSON, Charles Miner, American editor and author: b. Montpelier, Vt., 24 March 1864. Following his graduation from Harvard in 1886 he became literary editor of the Boston Advertiser (1887-90); associate editor of the Youth's Companion (1890-1911) and later a part owner and editor of the editor of that journal. He is noted as a writer of stories for boys. His publications include 'The Nimble Dollar' (1895); 'The Calico Cat' (1908); 'An Army Mule' (1910).

THOMPSON, Daniel Greenleaf, American lawyer, psychological and sociological writer: b. Montpelier, Vt., 9 Feb. 1850; d. New York, 10 July 1897. He was graduated from Amherst and was admitted to the bar in New York in 1872 but devoted himself chiefly to sociological work. Amherst conferred on him the Ph.D. degree in 1894. He became noted as a controversial writer and is known chiefly for 'A System of Psychology' (2 vols., 1884); 'Religious Sentiments of the Human Mind' (1888); 'Social Progress' (1889); 'The Philosophy of Fiction in Literature' (1890), and 'Politics in Democracy' (1893). The latter publication was translated into the Dutch language.

THOMPSON, Daniel Pierce, American author, lecturer, lawyer and politician: b. Charlestown, Mass., 1 Oct 1795; d. Montpelier, Vt., 6 June 1845. He was educated at Middlebury College, where he was graduated in 1822. He began life as a private lawyer, in which he studied law and was admitted to the bar in 1825. He settled in Montpelier the following year, held various judicial offices from that time to 1835 when he was authorized by
THOMPSON

lature to compile the laws of Vermont to 1834 (1835) and was elected sec-
state (1853-55). He edited the Green n Freeman (1849-56) and proved a vol-
writer. His publications include 'The-2es of Timothy Peacock, Esq.' (1835),
on the Anti-Masonic agitation; 'May or the Money Diggers' (1835), a prize terward reprint in London; 'The Mountain Boys' (1840); 'The Rangers' Tales of the Green Mountains' (1856); 'Gaelic Guttery of the Trapper of Lake z' (1857); 'The Doomed Chief' founded on the story of King Philip, tales based on Revolutionary stories.

an unfinished novel, 'The Honest

THOMPSON, Elizabeth Rowell, America
philanthropist: b. Lyndon, Vt., 21 Feb. 1821; d. Littleton, N. H., 20 July 1899. She was married to Thomas Thompson, a Boston millionaire, in 1845, and during his life engaged with him in philanthropic work. On his death in 1869 she inherited the vast income from his estate, and continued her charitable labors. She was an advocate of temperance reform, wrote a tract, 'Figures of Hell,' which was widely read, and contributed large sums for the furtherance of the cause. She gave $10,000 for an investigation of yellow fever in the South, and purchased and presented to Congress Carpenter's painting, 'Signing of the Emancipation Proclamation by President Lincoln in the Presence of his Cabinet.' She invested more than $100,000 in establishing head offices for her business, founded the town of Long Mont, Kan., and gave to each colonist 640 acres of land and $300. She contributed to the purchase of the Vassar College telescope, and was a generous benefactor of the American Association for the Advancement of Science, of which she was made the first patron. She was stricken with paralysis in 1888 and was afterward unable to continue his philanthropic work. In 1891 she pronounced insane by a Kansas City court, and a curator was appointed to the charge of her property in Missouri. She left an estate appraised at $400,000 with no public bequests.

THOMPSON, Francis, English poet: b. Ashton, Lancashire, 1860; d. London, 13 Nov. 1907. He was the son of a Lancashire physician, was educated at Ushaw Roman Catholic College, near Durham, and studied medicine at Owens College, Manchester. He took no interest in medicine, and turning his attention to literary work he went to London. Here after a struggle with poverty and hardship for some five years his work was brought to the attention of Alice Meynell (q.v.) through whose assistance and that of her husband, Wilfred Meynell, Thompson soon achieved reputation as a poet, and his fame steadily increased. Truly an ascetic, he stood alone among contemporary poets both for purity of thought and beauty of expression. He contributed to the critical reviews and published 'Poems' (1893); 'Sister Songs' (1895), and 'New Poems' (1897). Of his prose works, published posthumously, may be mentioned 'Life of Saint Ignatius Loyola' (1909); 'A Renegade Poet, and Other Essays' (1910); 'Life of John Baptist de la Galle' (1911). Consult his 'Works' (3 vols., New York 1913); also Beacock, G. A., 'Francis Thompson' (Marburg 1912); Meynell, E., 'Life of Francis Thompson' (New York 1913); Rooker, K., 'Francis Thompson' (London 1913).

THOMPSON, George, English reformer: b. Liverpool, England, 18 June 1804; d. 7 Oct. 1878. He acquired notoriety during the agitation by lecturing in the British Colonies. His subsequent tour in the United States produced great excitement and caused President Jackson to denounce him in a mes-
o to Congress. He was a friend of Carri-
son, Whittier and others in the anti-slavery movement and visited America several times. His influence aided materially in preventing the recognition of the South by Great Britain during the Civil War. He also took a prominent part in the Anti-Corn Law League and the British India Association to secure better government for India; was a member of the British Parliamentary Reform Association, and was elected member of Parliament 1847-52.

THOMPSON, Sir Henry, English surgeon: b. Framlingham, Suffolk, 6 Aug. 1820; d. London, 18 April 1904. He was educated at University College, London, and was awarded the Jacksonian prize in 1852 for an essay on 'The Pathology and Treatment of Stricture of the Urethra,' and again in 1860 for an essay on 'The Healthy and Morbid Anatomy of the Prostate Gland.' In 1853 he became assistant surgeon to University College Hospital, surgeon 10 years later, professor of clinical surgery in 1860, and consulting surgeon in 1847. In 1884 he was professor of pathology and surgery in the Royal College of Surgeons. He received numerous honors from foreign countries, was knighted in 1867, and created a baronet in 1899. His works treat mostly of the urinary organs and their diseases, of cremation, and of diet. Among his books is mentioned 'Clinical Lectures on Diseases of the Urinary Organs' (8th ed., 1888); 'The Preventive Treatment of Calculus Disease' (1888); 'Tumors of the Bladder' (1894); 'Cremation, or the Treatment of the Body after Death' (1874); 'Modern Cremation, its History and Practice' (4th ed., 1901), in which he advocates the substitution of cremation for the present method of sepulture; 'On Food and Feeding' (11th ed., 1901). He was also an artist of note, a pupil of Alma Tadema and others, and exhibited pictures at the Royal Academy, the Salon and elsewhere.

THOMPSON, Jacob, American politician: b. Caswell County, N. C., 15 May 1810; d. Memphis, Tenn., 24 March 1888. He was graduated at the University of North Carolina in 1831, and studied law at Oxford and engaged in the practice of law in Chickasaw County, Miss., in 1835. He was a member of Congress in 1839-51, and opposed the Compromise of 1850 as not sufficiently favorable to the South. He was appointed Secretary of the Interior by President Buchanan in 1857, and in December 1860, while still holding that office, he was appointed a commissioner from Mississippi to urge upon North Carolina the adoption of a secession ordinance. In January 1861 he resigned from the Cabinet in consequence of the action of President Buchanan in sending reinforcements to Fort Sumpter, which he declared to be a violation of an understanding with the Cabinet that the order should not be given without the knowledge of that body. He took an active part in the subsequent secession movement, was governor of Mississippi in 1862-64 and later served as aide to General Beauregard and inspector-general for the Department of Mississippi. He was Confederate commissioner to Canada in 1864, and a promoter of the邕aimiled law and coin engineering at Crawfordsville. Out-door life was his passion, and in 1885 he was State geologist of Indiana and chief of the Department of Natural History. In 1890 he joined the staff of the New York Independent. His books are the record of observations of a nature lover rather than a scientist, the product of his trips to the land and swamp regions of Florida and Louisiana, and to the hills of Alabama, Mississippi, and Georgia. He was a member of a hunting party, with which he huntedt instead of a gun. He wrote 'The Witchery of Archery' (1886); 'His Second Campaign' (1882); 'By-Ways and Bird Notes' (1885); 'The Boy's Book of Sports' (1886); 'Sylvan Secrets' (1887); 'Pest' (1892); 'The Ocala Boy' (1892); 'My Old Garden' (1900); 'Alice of Old Virginia' (1900).

THOMPSON, Sir John David, Canadian jurist and for some time Premier of the Dominion: b. Halifax, 10 Nov. 1844; d. Windsor, England, 12 Dec. 1884. He was the son of a family who had come from Waterford, Ireland, the office of queen's printer. Thompson attended the common school, Halifax, was called to the bar in that city in 1865, joined the Roman Catholic Church in 1866, and was created a baronet in 1874. In 1875, he was appointed to the Nova Scotia assembly for Anson in 1877. He was attorney-general in 1878 and premier the province in 1879. After the defeat of government in the same year Thompson was made a judge of the Supreme Court of Nova Scotia. This position he resigned to accept the portfolio of Minister of Justice in Sir John A. Macdonald's Cabinet (1882), entered the Dominion Parliament as member for Antigonish. He remained Minister of Justice until 1889, distinguishing himself by his oratorical power in the unruly industry. In 1887 he visited Washington as one of the commissioners at the fisheries question. The honor of knighthood was conferred on him in August 1888. John again visited Washington as one of the representatives of his government in the unsuccessful reciprocal negotiations of 1889-92. He was understood to have offered the position of Premier on the death of Sir John A. Macdonald (1891), but prefered to remain as Minister of Justice under leadership of Sir J. J. C. Abbott. On the retirement of the latter (December 1892), John Thompson became Prime Minister. Incessant Parliamentary labors rapidly undermined his health and brought about his sudden death immediately after the cabinet considered $1,200,000 for the construction of a new telegraph line to the United States. Sir John Thompson! (Toronto 1893).

THOMPSON, John Reuben, American journalist and poet: b. Richmond, Va., 26
30 Oct. 1873. He was graduated from University of Virginia in 1844; practised law in 1845, before entering into a career in journalism. In 1859 he edited the Literary Messenger to which Donald Hall contributed his "Reveries of a". His health caused his removal to Ga., where in 1859 he edited the Field magazine. Driven to London by the Civil War he actively defended the Confederacy in contributions to English and American newspapers. At the close of the war he returned to New York and became editor of the New York Post. He was author of several books which were popular at the time.

**Thompson, Joseph Parrish**, American novelist and Oriental scholar: b. Philadelphia, Pa.; d. Berlin, Germany, 27 Sept. 1879. He was educated at Yale College and graduated in 1838. He studied theology and was ordained Congregational minister. He was pastor of two churches in New York City. In 1857 he was appointed editor of the New York Post. He was author of several books, including "The Bible in America" (1856), "A Trysting Place" (1857), and "The Life of the Prophet" (1859). He was also a contributor to the New York Times and the Atlantic Monthly.

**Thompson, Richard Wigginton**, American lawyer: b. Culpeper County, Va., 9 June 1809; d. Terre Haute, Ind., 9 Feb. 1900. He was admitted to the bar of Lawrence County, Ind., in 1834. He served in both houses of the Congress of the United States, and in 1840 was elected to the Senate. He declined an appointment as Minister to Austria in 1849, and later the post of solicitor-general of the Land Office, which President Fillmore offered him. In 1867 he became judge of the Fifth Circuit Court, and in 1877-81 was Secretary of the Navy. He resigned this post before the completion of his term in order to become chairman of the American committee of the Panama Canal Company. He published "The Papacy and the Civil Power" (1877), "History of the Protective Tariff" (1888); "Footprints of the Jesuits" (1894) and "Recollections of Sixteen Presidents, from Washington to Lincoln" (1894).

**Thompson, Robert Ellis**, American educator: b. near Lurgan, Ireland, 5 April 1844. He was graduated at the University of Trinity College, Dublin, in 1865 and from 1865 to 1872 held successively in the chair of Latin and mathematics, social science, history and English literature. He has had lectureships in Harvard, Yale and Princeton Theological Seminary, and has contributed editorially to the "Penn Monthly", the "American, the Irish World and the Sunday School Times". In 1875 he was ordained to the Presbytery of Philadelphia. Since 1894 he has been principal of the Central High School of Philadelphia. His publications include "Social Science and National Economy" (1875); "De Civitate Dei" (1891), being his Stone lectures at Princeton; "History of the Presbyterian Churches of America" (1895); "Protection to Home Industry" (1885), being his Harvard lectures; "The Hand of God in American History" (1902); "The Historic Episcopate" (1903) and "The History of the Dwelling House and its Future" (1914). He has edited Duffield's "Latin Hymn-writers and Their Hymns" (1889); "Politic Economy for High Schools" (1895); "The Apostles as Everyday Men" (1912).

**Thompson, Silvanus Phillips**, English physicist: b. York, 19 June 1851; d. 1896. He was educated at Bootham School, York, at Flounders' Institute, Pontefract, and at the Royal School of Mines. In 1876-85 he held the professorship of experimental physics at University College, Bristol, and in 1885 became principal and professor of physics in the City and Guilds Technical College, Finsbury. He was president of the Physical Society; of the Institution of Electrical Engineers and of the Röntgen Society. His works include "Elementary Lessons in Electricity and Magnetism" (1881; rev. ed., 1915); "Dynamo-Electric Machinery" (1886); "Light, Visible and Invisible" (1897; 2d ed., 1910); "Michael Faraday" (1898); "The Life of Lord Kelvin" (1910).

THOMPSON, Vance, American journalist and playwright: b. 17 April 1863. He was graduated at Princeton in 1883, studied in Germany and was a dramatic critic in New York in 1890-97. His dramas include 'In Old Japan,' 'The Dresden She-Medics,' 'Floridan's Dream,' etc.; and among his books are 'French Portraits: Being Appreciations of the Writers of Young France' (1900); 'Dramatic Mysteries' (1905); 'The Spinners of Life'; 'Life and Letters of Ethelbert Nevin' (1913); 'The Night Watchman and Other Poems' (1914); 'The Ego Book' (1914); 'Eat and Grow Thin' (1914); 'Drink and be Sober' (1915); 'The Carnival of Destiny' (1916); 'The Peace Girl' (a romantic comedy drama) (1916); 'Women' (1917).

THOMPSON, Waddy, American lawyer: b. Pickensville, S. C., 8 Sept. 1798; d. Tallahassee, Fla., 23 Nov. 1868. He was graduated at the South Carolina College in 1814, admitted to the bar in 1819 and in 1826-30 served in the State legislature, became solicitor of the Western Circuit in 1830, was elected brigadier-general of militia at the time of the Nullification excitement and in 1835-41 was a Whig member of Congress. In 1840 he was chairman of the Committee on Military Affairs. He was appointed United States minister in 1842, and while on this mission concluded two important treaties and procured the liberation of more than 200 Texan prisoners. He published 'Recollections of Mexico' (1846).

THOMPSON, William, American Revolutionary officer: b. Ireland, about 1725; d. near Carlisle, Pa., 4 Sept. 1781. He served as captain of militia in the French and Indian War (1754-60) and was made colonel of eight Pennsylvania companies in June 1775. The following year he took the same rank in the Continental army and in 1778 became brigadier-general. He relieved Gen. Charles Lee at New York and in April led 14 regiments to Canada to re-enforce General Thomas, during whose illness he commanded until General Sullivan arrived. By the latter's orders he led an unsuccessful attack on the British at Trois Rivieres on 6 June and was captured but immediately paroled.

THOMPSON, William Hale, American mayor: b. Boston, Mass., 14 May 1849. In infancy he was removed to his parents in Chicago, where he was educated in the public schools. He spent five seasons on the ranches of the Standard Cattle Company in Colorado, Montana and Wyoming; was for three years manager of a cattle ranch in Nebraska. Since his marriage to Miss Thomas he has managed the real estate interests left by his father and other real estate interests of his own. In 1900-02 he served as alderman from the second ward of Chicago; in 1902-04 was county commissioner of Cook County and in 1915-19 was mayor of Chicago.

THOMPSON, William Horry, American lawyer and legislator: b. Granville, Ind., 14 Oct. 1871. The family moved to Illinois while he was a child and he was reared at the Seneca Normal School. He studied law and was admitted to the bar in 1894. He was elected judge of the Second Circuit Appeals (1906-13) and was elected as a delegate to the Democratic National Convention in 1912. He was elected senator in 1913. In 1916 he was a delegate to the Democratic National Convention.

THOMPSON, William Tappan, American newspaperman and humorist: b. Ravenna, 31 Aug. 1812; d. Savannah, Ga., 24 March 1880. He lived for a time in Philadelphia, worked on the Chronicle; afterward in New York, but died in San Francisco. He was a volunteer in the Seminole War (1835-36), and in 1848 was a member of the California Constitution. He was a contributor to the New York Mirror in Augusta, Ga., afterward to the New York World. He was a humorist in the effort at the New York World to make the New York Mirror in Augusta, Ga., afterward to the New York World. He was a humorist in the New York World. He was a humorist in the New York World. He was a humorist in the New York World. He was a humorist in the New York World. He was a humorist in the New York World. He was a humorist in the New York World. He was a humorist in the New York World. He was a humorist in the New York World. He was a humorist in the New York World. He was a humorist in the New York World. He was a humorist in the New York World. He was a humorist in the New York World. He was a humorist in the New York World. He was a humorist in the New York World. He was a humorist in the New York World. He was a humorist in the New York World. He was a humorist in the New York World. He was a humorist in the New York World. He was a humorist in the New York World. He was a humorist in the New York World. He was a humorist in the New York World. He was a humorist in the New York World. He was a humorist in the New York World. He was a humorist in the New York World. He was a humorist in the New York World. He was a humorist in the New York World. He was a humorist in the New York World. He was a humorist in the New York World. He was a humorist in the New York World. He was a humorist in the New York World. He was a humorist in the New York World. He was a humorist in the New York World. He was a humorist in the New York World. He was a humorist in the New York World. He was a humorist in the New York World. He was a humorist in the New York World. He was a humorist in the New York World.

THOMPSON, Wordsworth, American artist: b. Baltimore, Md., 27 May 1840; d. Philadelphia, N. J., 28 Aug. 1896. He began to paint in New York, but made several trips abroad later in his life. He was a member of the Society of American Artists, the National Academy, and the Pennsylvania Academy of the Fine Arts. He was a member of the Society of American Artists. In 1876 he was a member of the Society of American Artists. In 1876 he was a member of the Society of American Artists. In 1876 he was a member of the Society of American Artists. In 1876 he was a member of the Society of American Artists.

THOMPSON, Conn., town in V welding, Quinebaug villages of Grosvener Dale, North Dale, New Boston, Thompson, East West Thompson, Wilsonville, Mecham Quinebaug. It is in an agricultural area of manufacturing establishments and the production of iron, steel and finished products, flour and macaroni, wool, hats and shoes factory. Thompson was originally a part of a larger town, but became a separate town in 1728, and its territory was incorporated as a town in 1824.
OMPSOM INDIANS. See SALISHAN.
OMPSOM'S STATION. Battle of. The battle of Stone River (q.v.) the Con-
eese River, occurred about 8 miles west of Roanoke's and near, and late in February 1863 Gen-
an Dorn, with over 6,000 men, crossed the Mississippi River and marched ar
to Columbus, on Duck River, threat-
franklin, about 28 miles nearly west of est,
March General Rose-
ordered a general reconnaissance in front
lines to ascertain the Confederate
and, if possible, the enemy's intention.
these reconnoitering columns was sent
Franklin. It was under command of Col.
Coburn and consisted of his brigade—
d 85th Indiana, 19th Michigan and 22d
— the 124th Ohio, 600 cavalry under
J. Jordan and Aleshire's Ohio battery
guns; in all 2,837 officers and men. A
101 wagons accompanied the expedition,
which were to collect forage. Coburn
struck to advance the first day to
Hill, where he was to halt for the night
the next day, with a wide
of it to Rally Hill, on the left, to meet
erating cavalry column from Murfrees-
clud, with the cavalry and the battery,
ance and when three miles out of Frank-
Gen. W. H. Jackson's cavalry division
brigades and King's battery moving
Brigades formed line for battle, A-
pedia with his guns, King's guns re-
he skirmishers became engaged, and
brisk engagement of an hour Jackson
w toward Spring Hill and Coburn went
four miles south of Franklin. One
fire's guns had been disabled and with
age train of 80 wagons, half of them
was sent back to Franklin. Van Dorn
from Columbus that morning with
brigades of Gen. W. B. Forest, W. T.
G. B. Cosby, F. C. Armstrong and Col.
Whitfield, 6,000 men and 12 guns, and
ackson with the two brigades of Ar-
and Whitfield fell back after the engage-
man commuted line for Thompson's
nine miles south of Franklin, and
Coburn's advance. Jackson's division
ned on a range of hills crossing the
pike, with King's battery on the ex-
and Forrest's brigade, with a battery,
Jackson's right. On the morning of the
urn advanced cautiously and on nearing
on's Station Jordan charged with his
drove a small Confederate force from
ion and seized a range of hills near it
of the battery, which was captured when, on entering a pass, with hills on
ide, he was arrested by shells from the
tillery on his right and left, en-
his line. It was necessary to dislodge
ad of the attack; Aleshire's guns on opposite
the turnpike and railroad which ran
each other, the guns supported by the
the 33d and 85th Indiana advanced
b hill against King's battery, when sud-
tly Confederate reinforcements behind a stone wall Whitfield's brigade,
reinforced by a regiment of Armstrong's,
opened a fire that drove the two regiments back
hill. Whitfield followed, and when
neering the summit he was charged and
be behind the depot of Thomp-
Station and with the assistance of two
King's guns compelled Coburn's men to fall
behind the hill. At about the same time
Coburn was informed that about 1,000 cavalry
had been discovered on the left and he
olved to retreat; but it was first necessary to check
the Confederate advance. The movement in
retreat was to be covered by the battery and
the cavalry, but when Jordan saw the signs of a
movement in retreat and the probability of be-
ing cut off by Forrest's cavalry on the left, he
ordered the wagon train and its guard to the
rear, to be followed by the battery. Jordan fol-
lowing the battery after a slight resistance to
Forrest. Meanwhile Armstrong and Whitfield
had been ordered to assault Coburn's left and
Forrest to reach his rear. Armstrong, Whit-
field and part of Forrest charged, and after a
fierce struggle for the crest of the hill were
again driven from it with great loss. Again the
Confederates charged; Coburn was forced
back; Forrest, with two regiments, gaining his
rear, charged him; and after a few volleys at
close quarters Coburn surrendered. His loss,
as officially reported, was 48 killed, 247 wounded,
and 1,151 captured or missing. Van Dorn's loss
was 56 killed, 289 wounded and 12 missing.
Meanwhile other columns had pushed out from
Murfreesboro and driven other bodies of Con-
federate cavalry across Duck River and Gen.
Gordon Granger, commanding the reserve corps
of Rosecrans' army, upon hearing of Coburn's
defeat, strengthened Franklin and concentrated
a column at that place to move upon Van Dorn,
at Spring Hill and Thompson's Station. Granger
moved on the 9th, attacked and drove
Armstrong's cavalry brigade from Thompson's
Station and advanced to Spring Hill, Van Dorn
having fallen back during the day to recross
Duck River at Columbia. On the next day
Granger's cavalry, pushed Armstrong across
Rutherford's Creek near Columbia; and Van
Dorn's main body recrossed Duck River. Pur-
suit was suspended and on the 11th the various
commands engaged in the general reconnois-
ance returned to their former positions.
Consult 'Official Records' (Vol. XXIII); Van
Horne, 'History of the Army of the Cumberland'
(Vol. I); Wych, 'Life of Gen. N. B.
Forrest.'

E. A. CARMAN.

THOMSON, tóm'són, Charles, American
patriot: b. Maghera, County Derry, Ireland, 29
Nov. 1729; d. Lower Merion, Pa., 16 Aug. 1824.
He came to America in 1740, was educated in
the academy at Thunder Hill, Md., and became
a teacher in the Friends' Academy, Newcaste,
Del, afterward taught in Philadelphia, and then
engaged in business in that city. He acted as
commissioner among the Indians and in 1756
was adopted into the Delaware tribe as the
'Truth Teller.' From the first he ardently es-
poused the cause of the colonies, and in 1774
was made secretary of the Continental Con-
gress, a post he occupied until 1789. Upon
Washington's election to the Presidency he was
sent to Mount Vernon to inform him of the
event. He then retired from public life and
afterward occupied himself with literary labors.
He published 'An Enquiry into the Causes of the Alienation of the Delaware and Shawanese Indians' (1759); 'The Holy Bible, containing the Old and New Covenant, translated from the Greek (the Old Covenant from the Septuagint)' (1808), and 'A Synopsis of the Four Evangelists' (1815). Consult Harley, 'The Life of Charles Thomson' (1900).

THOMSON, Sir Charles Wyville, Scottish naturalist: b. Bonsyde, Linlithgow, 5 March 1830; d. there, 10 March 1882. He was educated at the University of Edinburgh, where he took the medical course and showed great ability in botany and natural history. He was appointed lecturer on botany in King's College, Aberdeen, in 1850 and professor at Marischal College in 1851. He filled the chair of natural history in Queen's College, Cork, in 1853 and in 1854 went to Queen's College, Belfast, as professor of mineralogy and geology. In 1860 he was transferred to the chair of natural science in the same college and in 1868 became in addition professor of botany in the Royal College of Science at Dublin. He returned to Scotland in 1872 to become professor of natural history in the University of Edinburgh. He took an active part in the scientific investigation of the British seas by the Lightning and Porcupine expeditions and published 'The Life of the Sea' (1873). He was appointed in 1872 chief of the scientific staff of the Challenger Expedition (q.v.), and on its return in 1876 he knighted. In 'The Voyage of the Challenger: the Atlantic' (1877) he gave a general account of part of the investigations carried out on the famous voyage.

THOMSON, Edward, American Methodist Episcopal bishop: b. Portsea, England, 12 Oct. 1810; d. Wheeling, W. Va., 22 March 1870. He came to the United States in 1819, was graduated in medicine at the University of Pennsylvania in 1829 and practised in Jeromeville and Wooster, Ohio. In 1832 he united with the Methodist Church and in the following year was admitted into the Ohio Conference. He was pastor of a church in Detroit, Mich., in 1836 and in 1839 was called to the Normal Seminary. He was the first president of the Ohio Wesleyan University at Delaware, in 1846-60, and in 1864 he was elected bishop, in which office he continued until his death. He edited the Ladies Repository at Cincinnati 1844-46, the Christian Advocate and Journal, New York 1860-64, made a missionary tour of the world and published 'Moral and Religious Essays' (1856); 'Sketches, Biographical and Incidental' (1856); 'Our Oriental Missions' (1870); 'Evidences of Revealed Religion' (1872); and other works.

THOMSON, Edward William, American civil engineer and author: b. Toronto, Ont., 12 Feb. 1849. He was educated in Trinity College Grammar School and by his own exertions. When but 16 he enlisted and served in the 3rd and 4th Pennsylvania regiments; and in the Queen's Own Rifles in 1866. He became a political writer on the Toronto Globe (1859-91); was editor of the Youth's Companion, Boston (1859-1901), after having become a special writer on Canadian politics. He was also the traveling correspondent of the Evening Transcript, Boston. His published works include 'Old Man Savarin' (1899), 'Between Earth and Sky' (1897), 'Assassin and Nicaragua' (1895, versified from the translation); 'We Lincoln Died, and other poems' (1899), etc.

THOMSON, Elihu, American inventor and electrician: b. Manchester, England, 29 Mar. 1853. In 1858 he came to the United States, educated in the public schools in Philadelphia and from 1857 to 1858 was a professor of chemistry and mechanics in the Central High School. After a visit to the Paris Exposition 1858 he became interested in the subject of lighting by electricity and his experiments carried on with the aid of E. J. Houston, resulted in patents secured in 1878 and 1879. The following year he became electrician to the American Electric Company, afterward known as the Thomson-Houston Electric Company. By consolidation with the Edison Company 1892, became the General Electric Company, the largest plant for producing electrical machinery in the world. His patented inventions in electrical appliances number over 600, many of them have come into universal use. Among these are the three-phase alternator, the dynamo motors; the system of distribution; the induction motor; the constant-current regulator for arc-light; the process of welding metals; the electric battery; the magnetic blow-out for arc lamps and fuses and the electric meter for street lighting on alternating currents. Since 1892, when the General Electric Company established its plant at Lynn, Mass., he has resided there, retaining his connection as consulting electrical engineer.

In 1899 he became president of the American Institute of Electrical Engineers, and in 1899 received from the Paris commission half prize of 10,000 francs for his meter. He was decorated in 1889 for electrical inventions of the French government as Officier de la Legion d'Honneur; given the highest degrees of A.M., Yale, D.Sc., Harvard and P. Tufts; has received many medals and awards, among which is the Rumford Medal, and was awarded Grand Prix at Paris exhibitions 1886 and 1889. He is a fellow of American Institute of Electrical Engineers, Fellow of American Academy of Arts and Sciences, member of the Institution of Civil Engineers, London, the American Chemical Society, the American Physical Society, the National Academy of Sciences, the various societies, and was official United States delegate to the Chamber of Delegates, Electrical Congress in 1893 at Chicago. He has been for many years a Fellow of the American Association for the Advancement of Science, serving as vice-president at the Columbus meeting, section B, Physics; and has been vice-president of the American Physical Society. He was president of the International Electrical Congress at Saint Louis in 1904 and also president of the Chamber of Official Delegates at said Congress. He was elected honorary member of the Institution of Electrical Engineers of Great Britain in 1904. In 1909 he was eldest president of the International Electrical Commission, succeeding the late Lord Kelvin as such. In 1899 he was made a special writer on Canadian politics. He was also the traveling correspondent of the Evening Transcript, Boston. His published works include 'Old Man Savarin' (1899), 'Between Earth and Sky' (1897), 'Assassin and Nicaragua' (1895, versified from the translation); 'We Lincoln Died, and other poems' (1899), etc.
titute, Philadelphia, for his electrical
Among the most notable of his papers
d for scientific societies are that on
c Welding, read before the Boston
of Arts in 1886, and one prepared for
ican Institute of Electrical Engineers,
 Novel Phenomena of Alternating
CSOM, Frank, American engineer
road president: b. Chambersburg, Pa.,
d. Merion, Pa., 5 June 1899. As
l he acquired a thorough practical and
c knowledge of mechanical engineering,
when he quit the shops of the Penn-
road at Altoona, he was able to
 locomotive. As chief assistant to the
r Secretary of War, he constructed
nd bridges and superintended the trans-
of troops during the Civil War; after
he was appointed superintendent of the
division of the Philadelphia and Erie
. He entered the service of the
vania Railroad in 1873 and as superin-
of the eastern system constructed the
s road-bed and introduced the standard
From 1897 until his death he was presi-
the company.
OMSON, George, Scottish song col-
b. Limekins, Scotland, 4 March 1757;
, Scotland, 18 Feb. 1851. He was edu-
t Banff and in 1780 removed to Edin-
where he became junior clerk to the
of trustees for the Encouragement of
Manufactures. He was subsequently
 succeed to be chief clerk, an office he held
s retirement in 1839. In 1792 he con-
the plan of making a complete collec-
Scottish airs, secured the services of
ll-known authors as Campbell, Scott
ns to supply words for the melodies
ecessary and since there was neither
nor coda to the songs he engaged Fleyel,
Beethoven, Mozart and others of note
by the deficiency and also to compose
ments for them. The results of his
en were as follows: Scottish airs
1793-1841); Welsh (3 vols., 1809-14),
sh (2 vols., 1814-16).
OMSON, James, Scottish poet: b. Ox-
boroughshire, 11 Sept. 1700; d. Rich-
, 27 Aug. 1748. He was educated
University of Edinburgh in 1715 and
 ended to enter the ministry, but in 1725
London to devote himself to literature.
 en on ‘Winter’ was published in the
year, in 1727 it was followed by
‘Spring’ appeared in 1728 and in
a series was completed and published
. It was very successful and
covered by his play ‘Sophonisba’.
 It Drury Lane in 1730. For two years
 on the Continent as traveling tutor to
Charles Talbot, afterward Lord Chas-
and in the death of his pupil in 1733,
pointed by the young man’s father to
ure office with a salary of £300 a year.
lished a patriotic poem entitled ‘Liberty’
6), included in 1736 in the volume with
; and ‘The Famous Rule Britannia,’
formed part of ‘The
of Alfred’ (1740), written by him with
and, David Mallet, to music composed
by Dr. Arne. In 1744 Lord Lyttelton conferred
upon him the sinecure office of surveyor-gen-
eral of the Leeward Islands, worth £300 a year.
In the same year he is mentioned in ‘The Seasons’ with extensive additions
and alterations, and in 1748 appeared ‘The Castle
of Indolence: An Allegorical Poem,’ a fine
imitation of Spenser. He was buried in the
parish church of Richmond. Among his works
not already mentioned are ‘The allegas’ (1738), a play; ‘Edward and Eleonora’ (1739),
a play which was published but rejected by the
censor; ‘Tancred and Sigismunda,’ a tragedy
(1745), his most successful play, and ‘Coriolanus’ (1749), a posthumously acted play. ‘The
Seasons’ marks the dawn of a new era in
English poetry, an era characterized by a
departure from the formation and artificiality of
Pope and his school in favor of simplicity and
ruthlessness to nature. The impulse gathered
strength in Gray and Cowper, and reached its
fullest expression in Wordsworth. The work
found warm admirers in France and other
countries and is still read. A good recent edition
of Thomson’s works is the ‘Aldine’ edition of
Tovey. (See SEASONS, THE.) Consult Morel,
L., ‘James Thomson, sa Vie et ses Œuvres’
(Paris 1895); ‘Life’ in Tovey’s edition; Bayne,
‘Thomson’ (‘Famous Scots Series,’ 1898); 
Macaulay, G. C., ‘James Thomson’ (New
York 1906).
THOMSON, James, British professor of
engineering: b. Belfast, 16 Feb. 1822; d. Glas-
gow, 8 May 1892. He was a brother of William
Thomson, Lord Kelvin, and was graduated
from the University of Glasgow in 1839. In
1851 he settled at Belfast as civil engineer and
in 1857 became Crown professor of civil engi-
eering at Queen’s College. Here he remained
until 1873, when he was called to the similar
chair at Glasgow. In early life he was devoted
to various inventive purposes, his first being
for the purposes of steamery paddles. More practical was his in-
vention in 1850 of a vortex water-wheel, and
later of a jet-pump used in draining lowlands,
a centrifugal pump and improvements in tur-
biners and in the action of turbines. For
many years he was engaged in investigations
of the plasticity of ice, his first contribution to
the subject (1848) being a paper communicated
to the Royal Society of Edinburgh on ‘The
Effect of Pressure in Lowering the Freezing
point of Water.’ The most important of his
contributions to this subject dealt with crys-
tallization and liquefaction as influenced by
pressures tending to change of form in crystals.
He also published researches on currents of
atmospheric circulation; on the flow of water
in rivers and on the jointed prismatic structure
seen at the Giants’ Causeway. Failure of eye-
sight caused him to resign his chair in 1889.
THOMSON, James, Scottish poet: b. Port-
Glasgow, 23 Nov. 1834; d. London, 3 June
1882. He was trained at Chelsea for the calling
of army schoolmaster and after teaching at
various regimental centres was discharged from
the army with several others for a breach of
discipline in 1862. He had gained the friend-
ship of Charles Bradlaugh (q.v.) and con-
tributed to his National Reformer over the
signature B. V. In 1872 he was in Colorado as
agent of a mining company and in the follow-


ing year went to Spain as a war correspondent for the New York World. In 1874 (March to May) he accompanied the National Reform Association; his most famous poem, ‘The City of Dreadful Night’ (printed in book form, with other poems, 1880), a finished, sombre work, in which his gloomy temperament clearly shows itself. His other works include ‘Vane’s Story’, ‘Weddah and Om-el-Bonain and other Poems’ (1881); ‘Essays and Phantasies’ (1881); ‘A Voice from the Nile and other Poems’ (1884); ‘Satières and Profanities’ (1884), and ‘Poems, Essays and Fragments’ (1892). His ‘Poetical Works’ were issued in two volumes in 1895 and a volume of ‘Biographical and Critical Studies’ appeared in 1896. (See City of Dreadful Night, The.) Consult the Life by Salt (1889; rev. ed., 1889); also Ward, English Poets (2d ed., Vol. IV, 1883).

THOMSON, John, Scottish painter: b. Dailly, Ayrshire, 1 Sept. 1778; d. Duddingston, 30 Oct. 1840. He studied for the ministry in Glasgow University for a year, in 1793 entered the University of Edinburgh and on his father’s death in 1799 succeeded him as minister of his native parish. In 1805 he was presented to the parish of Duddingston, near Edinburgh, and here he rapidly acquired fame as a landscape-painter and developed a close friendship with Sir Walter Scott. His pictures were much in demand and he exhibited frequently in Edinburgh. On the foundation of the Scottish Academy in 1830 he was elected an honorary member, after declining ordinary membership. Many of his pictures are in the National Gallery of Scotland, but a considerable number are housed in private collections. Among the former are ‘Bruce’s Castle of Turnberry’, ‘Ravenshagh Castle’, ‘Scene on the Clyde’, ‘The Trosachs’, ‘Aberlady Bay’, and ‘Trees on the Bank of a Stream.’ The National Gallery in London contains ‘Loch an Eilan’ and the South Kensington Museum has a water-color of ‘Duddingston Loch.’ He felt throughout his artistic life the want of early and systematic training, but he holds a distinct place in the history of development of British art, as the first painter to grasp and express the wildness and power of Scottish scenery. Consult Baird, ‘John Thomson’ (1895).

THOMSON, Joseph, Scottish explorer in Africa: b. Penpont, Dumfriesshire, 14 Feb. 1858; d. London, 3 Aug. 1895. He was educated at the University of Edinburgh and there distinguished himself so highly that he was appointed in 1878 geologist and naturalist to the exploring expedition sent out to East Central Africa by the Royal Geographical Society under the command of Alexander Keith Johnston. When Johnston died, 28 June 1879, Thomson assumed the leadership of the party and conducted it to Lake Tanganyika and near the head-waters of the Kongo. A mutiny of his followers deposed him from his command and he returned by way of Lake Leopold, reaching the coast 10 July 1880. In 1882 he set out on a great journey from the east coast of Africa to Victoria Nyanza. This was undertaken on behalf of the National Agricultural Company and during it he visited Kilimanjaro and ‘Mount Kenia’ and proceeded through the country of the Masai by way of Lakes Naivasha and Baringo to Victoria Nyanza. In 1885 he was awarded the founder’s medal of the Royal Geographical Society and in the same year travelled to Zanzibar for the National Arab Company in order to conclude treaties with the kings of Sokoto and Gando. In 1888 he explored the Atlas Mountains in Morocco and in 1890–91 traveled on behalf of the British South Africa Company in the territory of the Cape and the Africa Protectorate. His travels are described in his works ‘To the Central African Lake and Back: the narrative of the Royal Geographical Society’s East Central African Expedition, 1878–80’ (1881); ‘Through Mainland: a Journey of Exploration Among the Snowclad Volcanic Mountains and Strand Tribes of Eastern Equatorial Africa’ (1885); ‘Travels in the Atlas and Southern Morocco: a Narrative of Exploration’ (1889). He also wrote a work on ‘Mungo Park and the Niger’ (1890) and a novel ‘Ulu’, with Miss Harriet Smith. Consult ‘Life’ by J. B. Thomson (1896).

THOMSON, Sir Joseph John, English physicist: b. Manchester, 18 Dec. 1836. He was educated at Owens College of his native city. In 1859 he was presented to the parish of Duddingston, near Edinburgh, and here he rapidly acquired fame as a landscape-painter and developed a close friendship with Sir Walter Scott. His pictures were much in demand and he exhibited frequently in Edinburgh. On the foundation of the Scottish Academy in 1830 he was elected an honorary member, after declining ordinary membership. Many of his pictures are in the National Gallery of Scotland, but a considerable number are housed in private collections. Among the former are ‘Bruce’s Castle of Turnberry’, ‘Ravenshagh Castle’, ‘Scene on the Clyde’, ‘The Trosachs’, ‘Aberlady Bay’, and ‘Trees on the Bank of a Stream.’ The National Gallery in London contains ‘Loch an Eilan’ and the South Kensington Museum has a water-color of ‘Duddingston Loch.’ He felt throughout his artistic life the want of early and systematic training, but he holds a distinct place in the history of development of British art, as the first painter to grasp and express the wildness and power of Scottish scenery. Consult Baird, ‘John Thomson’ (1895).

THOMSON, Thomas, Scottish antiquary and elder brother of Rev. John Thomson, the painter: b. Dailly, Ayrshire, 10 Nov. 1785; d. Edinburgh, 2 Oct. 1852. He was graduated from Glasgow University in 1789 and adopted the law, and in 1807 he was admitted an advocate in 1793. He acquired a large practice, but gradually devoted him more and more to the study of legal antiquities. In 1832 he succeeded Sir Walter Scott, who was one of his close friends, as Bannatyne Club. Among his numerous publications are ‘The Acts of the Parliament of Scotland, 1424–1707’ (10 vols., 1814–24); ‘The Instrument Magni Sigilli Regum Scottorum, 1142–1814’ (1814); ‘The Acts of Causes and Complaints, 1466–94’ (1831); and ‘Acts of the Lords of Council in Causes, 1478–95’ (1839); ‘Forms of Process in the Court of Session during the Early Periods, with the latter variations’ (1833); ‘Chamberlain Rolls’ (3 vols., 1817 and 1818); and ‘Memoirs of Sir George Mackenzies’ (1854) by Cosmo Innes.

THOMSON, Thomas, British chemist: b. Crieff, 12 April 1773; d. near Holy Loch, 7 July 1852. He was educated at Crieff, Stirling, and the University of Saint Andrews, and in 1799 graduated M.D. at Edinburgh. He edited the supplement to the third edition of the ‘Encyclopedia Britannica,’ to which he contributed the articles ‘Chemistry,’ ‘Minerals,’ and ‘Chemical Philosophy.’ His treatise on ‘The Art of Dyeing’ (1818) and his ‘A Treatise on Dyes’ (1820) were useful contributions to the knowledge of dyes and dyeing.

THOMSON, Thomas, British chemist: b. Crieff, 12 April 1773; d. near Holy Loch, 7 July 1852. He was educated at Crieff, Stirlingshire, and the University of Saint Andrews, and in 1799 graduated M.D. at Edinburgh. He edited the supplement to the third edition of the ‘Encyclopedia Britannica,’ to which he contributed the articles ‘Chemistry,’ ‘Minerals,’ and ‘Chemical Philosophy.’ His treatise on ‘The Art of Dyeing’ (1818) and his ‘A Treatise on Dyes’ (1820) were useful contributions to the knowledge of dyes and dyeing.
and 'Vegetable, Animal and Dyeing Substances.' In the article 'Minerology' he used the system of symbolic representation, but it is incorrect to describe him as the introducer of this auxiliary of chemical science. In 1800 on the completion of the 'Encyclopædia,' he began a course of lectures on chemistry, which he continued till 1811, opening, in addition, a laboratory for students. The institution of this laboratory is the first institution of the kind in Great Britain. In 1802 he published the first edition of his 'System of Chemistry,' which obtained rapid success both in Great Britain and on the Continent. In 1810 he published his 'Elements of Chemistry.' His 'History of the Royal Society' appeared in 1812. In 1813 he went to London and began there a scientific journal, the *Annals of Philosophy*, which continued to edit till the end of 1820. The lecturership in chemistry in the University of Glasgow was conferred on him in 1817, the office being shortly afterward raised to a professorship, and he himself created regius professor of chemistry in 1818. His work on the atomic theory was published in two volumes in 1825, using a method of establishing the First Principles of Chemistry by Experiment. The accuracy of the work was severely criticized by the Swedish chemist Berzelius. Thomson discovered a large number of chemical compounds, such as hyposulphurous acid and a great variety of salts. In 1830–31 he published his 'History of Chemistry,' and in 1836 appeared his 'Outlines of Mineralogy and Geology.' In 1846 he retired from his professional duties.

**THOMSON, William.** English archbishop; b. Whitehaven, 11 Feb. 1819; d. York, 25 Dec. 1890. He was educated at Queen's College, Oxford, of which he was successively fellow, tutor and head. Ordained deacon in 1842, he was curate at Saint Nicholas, Guildford and Cuddesdon, near Oxford, 1842–47, when he was made tutor of his college, of which he became provost in 1855. In 1861 he edited a series of essays by various writers under the title 'Aids to Faith,' intended as a counterpart to 'Essays and Reviews'; and in that year was appointed bishop of Gloucester and Bristol. In February 1863 he became archbishop of York. He was the author of 'An Outline of the Necessary Laws of Thought' (1842); 'The Atoning Work of Christ, viewed in Relation to some Current Theories' (1853); 'Crime and its Excuses' (in Oxford Essays, 1855); 'Life in the Light of God's Word'; 'Limits of Philosophical Inquiry'; 'Design in Nature'; and a series of essays entitled 'Word, Work and Will.'

**THOMSON, William, 1st Lord Kelvin.** British mathematician and physicist; b. Belfast, 26 June 1824; d. Glasgow, Scotland, 17 Dec. 1907. He was graduated from Cambridge in 1845, and in 1846 published a paper 'On the Uniform Motion of Heat in Homogeneous Solid Bodies, and in Connection with the Mathematical Theory of Electricity,' contributed to the Cambridge Mathematical Journal. In 1845 he became first editor of the *Cambridge and Dublin Mathematical Journal*, a post which he held for seven years. He was appointed professor of natural philosophy in the University of Glasgow in 1846, and occupied this position for 53 years, till his resignation in 1899. His jubilee as a professor was celebrated in 1896 by many brilliant university functions and distinguished visitors. The conditions came from many countries to do him honor. Lord Kelvin's contributions to physical science and its applications are very numerous. In all the domains of dynamics, sound, light, heat, magnetism and electricity there are achievements to his credit. The form of water in which the mariner's compass is now generally employed was patented by him in 1876, and the siphon recorder used in connection with almost all submarine cables was introduced by him in 1867. His extremely delicate mirror galvanometer was also originally invented for the purposes of submarine telegraphy, and in this connection his automatic curb sender is also worthy of notice. His quadrant and absolute electrometers are well known to students of electrostatics, and his portable electrometer and water-dropping apparatus are of great use in practical meteorology. He published important papers on the theory of magnetism, and the theory of electric images with the associated method of establishing the First Principles of Electricity by Experiment. Lord Kelvin was the first to direct the attention of scientific men to Sadi Carnot's pioneer work in thermodynamics, and it is mainly to his researches and those of Rankine and Clausius that we owe the present advanced condition of that science. The absolute scale of temperature based on the second law of thermodynamics was first proposed by Lord Kelvin. In the building up of the great modern doctrine of the conservation of energy Lord Kelvin took an important part, and the portion of that doctrine known as the dissipation of energy is almost entirely due to him. He also propounded a modified atomic theory in which the atoms are conceived as vortices, and he threw much light on such questions as the age of the earth, cosmic evolutions and geological time. Lord Kelvin, then William Thomson, was associated as electrician with the company which undertook the laying of an Atlantic cable in 1857, and was largely responsible for the success which ultimately crowned the heroic effort of submarine telegraphy in 1866. He might, indeed, be called the first electrical engineer. He was knighted in 1866, and in 1892 was raised to the peerage as Baron Kelvin of Wetherall, Laros, Ayrshire. He was president of the Royal Society from 1890 to 1895, and was awarded the Copley and Royal medals. In 1871 he presided over the meetings of the British Association at Edinburgh. He was Rede lecturer at Cambridge in 1866 and was many times elected president of the Royal Society of Edinburgh. He was awarded the Prix Poncelet by the Institute of France in 1874, and the Helmholtz medal by Germany in 1892. He received so many honors that there is not space to enumerate them. Perhaps the most notable was the jubilee celebration of his professorship at Glasgow University in 1896. The gathering was attended by 2,500 distinguished guests; the ceremonies and jubilation lasted three days. The Grand Cross of the Royal Victorian Order was conferred on him. The city officials joined in the event, cable companies all over the world sent congratulations and a message was sent from the university

The text is about the life and work of Sir William Thomson, known also as Lord Kelvin, a British mathematician and physicist. He made significant contributions to fields such as thermodynamics, electricity, and the theory of magnetism. He was a key figure in the development of submarine telegraphy and was involved in important research on the age of the earth and cosmic evolutions. Thomson was also a leading exponent of the modern doctrine of the conservation of energy and contributed to the establishment of the Kelvin temperature scale. His work and contributions were widely recognized, earning him numerous honors and awards throughout his career. The text includes a brief biography of Thomson, highlighting his early education, professional career, and significant contributions to science. The text also mentions his role in the laying of the Atlantic cable and his involvement in the British Association for the Advancement of Science.
half around the world, via Newfoundland, New York, San Francisco, New Orleans, Washington and back to London and Glasgow, being received by Lord Kelvin in seven and one-half minutes. Lord Kelvin's most important published work is the well-known "Treatise on Natural Philosophy" (Part I, 1867; new ed., 1879), written with Professor Tait. An abridged edition has also been published. His other works are "Papers on Electrostatics and Magnetism" (1873); "Mathematical and Physical Papers" (1882, 1884, 1890); "Popular Lectures and Addresses," and articles in the 9th edition of the "Encyclopaedia Britannica," some of which have been also published separately. He visited the United States in 1884, in 1892 and again in 1902. Consult his "Life" by Andrew Gray (1908), and by Thompson, S. P., (1910).

THOMSONITE, one of the zeolite family of minerals \((\text{H}_3\text{Si}_3\text{Al}_4\text{Si}_2\text{O}_{12})\). It usually occurs in columnar forms or radiated concretions of snow-white color, less frequently in compact orthorhombic crystals (comptonite). It is a hydrous silicate of aluminum, sodium and calcium. It is found filling cavities in igneous rocks in Scotland, the Faroe Islands, Nova Scotia, and Golden in Colorado, and elsewhere. Much so-called thomsonite, including the pebbles of Grand Marais, Minnesota, is mesolite.

THOR, thôr or tór, in Norse mythology, the god of thunder, son of Odin by Jörd (the earth). He was represented as a powerful man in the prime of life, with a red beard, girt with his girdle of strength, and armed with his mighty hammer Míöleir ("the smasher"). He was the foe of the giant demons, and friendly to man. Some have thought him identical with Jupiter; others identify him with the Anglo-Saxon, Thonar. Sacrifices were offered to him under oaks. Thursday has its name from him. Consult Ueland, "Der Mythus vom Thor" (1868).

THORACIC DUCT, a vertical canal lying in front of the spine, and receiving the terminations of the lacetal and lymphatic vessels. It is the receptacle for the materials which go to renovate the blood, these materials being derived from the digestion of food and from the elaborated products of the lymphatic glands. From the thoracic duct the chyle or nutrient matter is poured directly into the current of the circulation, the duct opening into the great veins (internal jugular and subclavian veins) lying at the root of the neck on the left side. A second and smaller lymphatic or thoracic duct lies on the right side of the body, and receives the contents of the lymphatics of the right arm and right side of the head. The chyle duct is dilated at its lower extremity, at the junction of the loins and back, into the receptaculum chyli. The contents of the thoracic duct contain the elements of the blood already elaborated.

THORAH, tôrâ, or TORAH, in Hebrew literature, a definite commandment laid down by recognized authority. When used with the definite article the word refers specifically to the Mosaic law, that is, the Pentateuch; and often to the Ten Commandments.

THORAX, that part of the trunk in higher vertebrates between the neck and abdomen containing the heart, lungs and other viscera, enclosed by the ribs, sternum and thoracic vertebrae. The most important bony structure that forms the chest. The term is also applied to those segments of the body in Arthropoda which lie between the head and the abdomen. Thus in insects there are three segments forming the thorax, namely, the prothorax, mesothorax and metathorax. The prothorax bears the first pair of legs, the mesothorax the second pair of legs and first pair of wings, while the metathorax bears the third pair of legs and second pair of wings. In crustaceans and spiders the head and chest segments are united together to form a single mass, named the cephalothorax. In man and higher vertebrates the thorax is formed by the sternum or breast-bone in part and by the ribs and spine, laterally and behind. In mammals alone is the thorax and its cavity completely shut off from the cavity of the abdomen by a complete diaphragm or midriff. See ANATOMY; ZOOLOGY; HUMAN; TORSO.

THOREAU, thôrô, Henry David, American "poet-naturalist": b. Concord, Mass., 12 July 1817; d. there, 6 May 1862. He was graduated at Harvard in 1837, and began in that year the copious journal with which in 1859-60 he filled 30 manuscript volumes, did some teaching at Concord and on Staten Island, N. Y., appeared occasionally as a lyceum lecturer in Concord and other New England towns that chose to call him, and, until his death, practised at intervals and with great skill his art of pencil-manufacture, making, Emerson said, as good an article as the best English. In 1839 he took the excursion recorded in "A Week on the Concord and Merrimack Rivers," which was published in 1849 in an edition of 1,000; the return of 700 as unsalable (1853) afforded him the humorous boast that he had now a fair-sized library all of his own writing. In the course of the voyage there are many observation and opinion, the result being less a narrative than a collection of essays and discussions. Chiefly for the preparation of this work, but also to undertake an experiment in simplicity of living, and to have opportunity for observation of wild nature, he lived alone in a house built by himself, from July 1845 to September, 1847, at Walden Pond, not far from Concord village. There, too, he wrote several of his papers and gathered material for his "Walden, or Life in the Woods" (1854), the best known and probably the most nearly classic of his books. After this episode, which some folk professed to think very odd, "he preferred," says Emerson, "short work," a building, hunting, grafting, surveying and other odd jobs, writing meanwhile for current periodicals. In 1848, 1853 and 1857 he went to the Maine woods, and his accounts, partially printed in magazines in his lifetime; were posthumously collected in book form, constituting what is perhaps after "Walden," his most interesting work. Other jaunts to Cape Cod (1849) and Canada (1850) were also described. The titles of these two "principal" volumes were also those of his "Walden, or Life in the Woods" (1854), "The Mountains of the Moon" (1864), "The Backwards" (1865); "Early Spring in Massachusetts" (1881); "Summer" (1884); "Winter" (1886);
THORIANITE—THORNE

Thorite, a mineral consisting of thorium and uranium oxides, about cent of the former and 12 per cent of the occurs at Norris, Madison County, Mont.

IORITE, a rare but important mineral almost exclusively in Norway. Theoretically, it is an anhydrous thorium silicate, but all analyses give the presence of erable water and more or less uranium, with no iron. The variety orange, which is of hot orange to lemon-yellow color, is the known thorium ore, containing by analysis 55% thorium. Thoronite is a reddish-brown color and contains 9 to 10% of uranium sesquisulfide. Thorite proper is very dark brown. It crystallizes in prismatic crystals isomorphic with zinc, the usual habit being a square prism terminated by a square pyramid. Prismatic cleavage is distinct and the fracture is conchoidal. Its hardness is 5.5 to 5, and the specific gravity ranges from 4.2 in some uranothorite to 5.4 in some orange. It is transparent in thin splinters to nearly opaque in large or altered masses. Its lustre is resinous, streak yellow to dark brown. Thorite was formerly one of the chief sources of supply of the rare earth thorium and is still of much value for that purpose, though its use has been supplanted.

THORIUM, one of the most valuable of the rare elements. It was discovered by Berzelius in a Swedish mineral and called by him thorium after the ancient Swedish god Thor. Found in the minerals thorite, orange, euxenite, aureite and in monazite sand. This latter substance is found in considerable quantity in Brazil and in North Carolina and is one of the most valuable sources of thorium and of a number of other rare elements related to it. Thorium, symbol Th, atomic weight 232, is a grayish metallic element that can be separated in an elementary condition by heating the chloride, ThCl₄, with metallic sodium. It is soluble in mineral acids and burns brilliantly to the oxide ThO₂, thorium, when heated in the air. This oxide is the most important compound of thorium as it is used together with the oxides of other rare elements to form the "mantles" for the Welsbach incandescent gas lights. See MINERAL PRODUCTION OF THE UNITED STATES.

THORN, förn, Germany, in Prussia, in the province of West Prussia, on the Vistula, 51 miles southwest of Marienbad. It is an important stronghold, the head of the eighth Prussian fortress district, a railway junction, surrounded by detached forts, and has withstood many sieges, the last being in 1915. It dates from 1231, and its principal buildings comprise the ancient castle, town-house and other gabled and handsome edifices; there is also a statue to Copernicus, who was born there. It was taken from Poland by Prussia in 1793. Its manufactures include machinery, castings, soap and a special gingerbread. There is a thriving trade in corn and timber, besides wood, linen, hides, bark and ashes. An important conference was held in 1645 to reconcile Protestant and Catholic differences, presided over by German and Polish churchmen, but was far from meeting with success. Pop. 46,227.

THORN-APPLE. See DATURA.

THORNDIKE, Edward Lee, American psychologist: b. Williamsburg, Mass., 31 Aug. 1874. He was educated at Wesleyan University (A.B., 1895), Harvard (A.B., 1896), Columbia (Ph.D., 1898), and taught in the Western Reserve University (1896-99). He became instructor in psychology in Columbia University (1899-1904) and has been professor there since the latter year. He is author of Educational Psychology (1903); Mental and Social Measurements (1904); Animal Intelligences (1911); The Original Nature of Man (1913); The Psychology of Learning (1914), and many monographs on similar subjects.

THORNE, Joseph, American inventor: b. Marlborough, N. Y., 17 Feb. 1826; d. Sing Sing, N. Y., 4 May 1897. He served through the
THORNHEADED WORMS — THORNWELL

Mexican War. Becoming an engineer he associated himself with Elias Howe while the latter was perfecting his sewing-machine. Afterward he was connected with the Singer Company and later established a factory in Scotland. He invented a typewriter, a sewing machine and a typesetting and distributing machine, which bear his name. This last machine was developed in Harvard, Conn. See COndef BORINES MACHINES.

THORNHEADED WORMS, ACANTHOCEPHALA, a group of parasitic round-worms (q.v.) of the genus Echinorhynchus, having the proboscis armed with a circle of hooks.

THORNHILL, Sir James, English painter: b. Melcombe Regis, 1676; d. Thornhill, Dorset, 13 May 1734. Queen Anne appointed him her sergeant-painter and he was much engaged in the decoration of palaces and public buildings, in which his chief works are to be found. Among his best efforts may he mentioned the dome of Saint Paul's, Great Hall at Greenwich Hospital and some rooms at Hampton Court. He also painted the altar-pieces at All Souls and Queen's colleges, Oxford. His forte was in the treatment of allegorical subjects. He was in his position as painter to King George I in 1720 and knighted in the same year. Hogarth clandestinely married Thornhill's daughter in 1729, and always expressed great admiration for that painter's work, which shows in no small degree his genius, although living critics have not confirmed the favorable verdict of George I and his contemporaries.

THORNS AND SPINES IN PLANTS, acute-pointed projections from the trunks, branches or twigs of plants. A thorn arises from the wood of which it is an outgrowth, whereas a prickle or spine is a growth from the bark and can be removed when the bark is peeled off. The raspberry and the rose are good examples of prickly-covered plants; the hawthorn and some wild plums of plants covered with thorns. Prickly and spines are believed to be useful to the plants which bear them, either as protections against the browsing of animals, as auxiliaries in climbing, holding their position, etc.; thorns are considered to be abortive branches, a deduction based upon the facts that in nature they often bear leaves, and under domestication may develop into branches. Various hawthorns exhibit the former phenomenon and the apple and pear the latter.

THORNTON, Sir Edward, English diplomat: b. London, 13 July 1817; d. there, 26 Jan. 1900. He was educated at King's College, London, and at Cambridge University and in 1842 was appointed attaché at Turin. He was engaged in important diplomatic missions to Mexico and the South American states in 1845-65, and in 1845-67 was Minister to Brazil. In 1847 he was appointed Minister to the United States, served on the commission to adjust the Alabama Claims in 1857 and was arbitrator in the commission on the United States and Mexican claims in 1873. He became Ambasador in Russia in 1861, to Turkey in 1884 and in 1887 retired from the diplomatic service.

THORNTON, John Wingate, American author: b. Saco, Me., 12 Aug. 1818; d. Scarboro, Me., 6 June 1878. He took his LL.B. degree at Harvard in 1840; was admitted to the bar and practised in Boston. The honorary A.M. degree was conferred on him by Bowdoin College in 1860. He was the founder of the New England Genealogical Society and was vice-president of the American Static Association. His published works chiefly include genealogical memoirs of distinguished men and families, including "Life of John Bowles," "Ancient Pemaquid," "Pulpits of the American Revolution" (1860) and the "Historical Relations of New England to the English Commonwealth" (1874). Consult "Memoirs of John Wingate Thornton" (Boston 1879).

THORNTON, Matthew, American legislator, signer of the Declaration of Independence: b. Ireland, 1714; d. Newburyport, Mass., 24 June 1803. He came with his parents to America in 1717, lived for a time at Wiscasset, Me., removed to Worcester, Mass., and there received his education. Entering the profession of medicine, he practised at Londonderry, N. H., and in the Louisburg expedition under Sir William Pepperell (1745) served as surgeon. He presided over the provincial convention which drafted the Declaration of Independence in the Continental Congress: and although he did not take his seat until November, and had not been elected when the Declaration of Independence was adopted, he was granted the special privilege of signing it. He had already been chief justice of the Court of Common Pleas in New Hampshire when in 1776 he was made a judge of the Supreme Court, and this office he held until 1782.

THORNTON, William, American architect and physician: b. Tortola, West Indies, 1722; d. Washington, D. C., 1827. He was educated as a physician and resided for a number of years in Philadelphia where he was well known for his scientific attainments and was a member of the American Philosophical Society. He was a skilled architect and designed the Philadelphia Library building, the building removed to Washington and planned the Capitol, of which he partly supervised the construction. He was the first commissioner of public buildings of the national capital and also was first Commissioner of the patent office, to which he was named in 1802. He wrote "Cadmus or the Elements of Written Language" (Philadelphia 1813).

THORNWELL, James Henley, American educator: b. Marlborough District, S. C., 9 Dec. 1812; d. Charlotte, S. C., 1 Aug. 1882. He was graduated in 1831 from the South Carolina College and studied law but declined to practise and finally was ordained by the Bethel Presbytery in 1834 and became pastor of the Lancaster Court House congregation. He was professor of logic, belles lettres and metaphysics in the South Carolina College (1837-1840), Columbus, S. C. (1840), returning to the college as professor of literature (1842-52). In 1841 he visited Europe. He served as president of the South Carolina College (1852-55). He was author of a number of tracts of theological subjects and his writings, edited by Rev. J. B. Adger were published in 1854, Consult Palmer, Ben, "Life and Letters" (Richmond 1875).
father. In his 11th year he entered the Academy of Arts, where he gained in 1793, along with other lovers of art, permission to travel abroad. He resolved to visit Rome, where he arrived in November 1797, and under the inspiration of Canova and Carstens the painter devoted himself to reproducing that idealism, the idealism of the ancients, which became even after the one object of his artistic life. It was not until 1803 that he became at all widely known. He had finished a model of Jason without finding a purchaser, when the well-known and wealthy Thomas Hope called at his studio and arranged with him to have it executed in marble. The fortune of its designer was now made. Commissions flowed rapidly in upon him, new creations from his hand followed in quick succession and his abilities as a sculptor became everywhere recognized. In 1819 he returned to Denmark, and his journey through Germany and his reception at Copenhagen bore the appearance of a triumph. His first works in this city were the busts of the king and queen. He was next employed by the community in the rebuilding of the Fruzirkirke or church of Our Lady, to design the decorations for the same, which now form its main ornament. In 1820 he returned to Rome, visiting on his way Berlin, Dresden, Warsaw and Vienna, and receiving numerous orders for works. He remained at Rome till 1838, when he undertook another journey to Copenhagen, being principally moved to this step by the contemplated establishment in that city of a museum of his works and art treasures. His return was a true national festival, both for Copenhagen and the whole of Denmark. With the exception of a short visit to Rome the remainder of his life was spent in the Danish capital, and he both took a vivid interest in the establishment of the Thorwaldsen Museum (q.v.) and enriched it by important contributions. Consult Thiele, ‘Thorwaldsen’s Biographie’ (1836); Pion, ‘Thorwaldsen sa Vie et ses Oeuvres’ (1867); both of these works have been translated into English; Hammerich, ‘Thorwaldsen und seine Kunst’ (1876).

THORVALDSSEN MUSEUM, a building and art collection at Copenhagen raised from funds left by the sculptor Thorwaldsen. The building was constructed after a plan furnished by the architect Bindesbøll, and is purely Greek in style. It contains the models and works bequeathed by the sculptor to his native city, which comprise 80 statues from his hand; three long alto-relievs and 130 busts. In the centre of the building is the highly decorated tomb of Thorwaldsen. The museum was opened in 1840.

THOTH, thoth or thô, an Egyptian deity identified by the Greeks with Hermes. He was originally the moon-god, and the invention of letters, arts and sciences was attributed to him. The ibis was sacred to him and he is represented with the head of that bird, and with the tail of the cobra. The dog-headed ape is also one of his attributes, and he is frequently depicted with a dog’s head. There were 42 sacred books bearing his name, which were under the guardianship of the Egyptian priests. These books he is said to have composed; and he accordingly appears in the monuments with tables and stylus. He has been identified with the Greek Mercury and Hesperus and the Roman Mercury and Iusoret.

THO THMES, thôth’éz or thô’t’éz (so of Thoth); the name of four Egyptian kings. Under Thothmes I, Egypt saw its darkest days come to end with the expulsion of the Hyksos and the revival of truly national art and civilization and of national power. The era of foreign invasion, with the emigration of the royal treasury, began. Ethiopia was made a tributary state, and eastward the limit of Egyptian power was pushed as far as the Euphrates. At his death Thothmes I was succeeded by Thothmes II, his eldest son, with Hatasu, his daughter, and Thothmes III, his younger son, as coregents. Thothmes II beautified Thebes, but his reign was brief and insignificant. Thothmes III was the Alexander of Egyptian history. After the death of Hatasu he entered upon that series of wars which comprised 14 campaigns, in the course of which he subdued Palestine, Syria, Mesopotamia in part, and large tracts of territory between the Euphrates and the Mediterranean. The names of the cities he took, including Kadesh and Tyre, are inscribed in large, transparent stelae on the walls of Karnak. He added extensively to the architectural glories of Thebes. As Hatasu, the Semiramis of Egypt, erased the name of the Thothmes II, her half-brother, from his monument at Karnak, so was his name erased with the record of her campaigns, during which she appeared in male attire, from the recording inscriptions by Thothmes III. He reigned from 1503 to 1440 B.C. He was succeeded by Amenhotep II at whose death Thothmes IV began his reign. The latter waged war in Ethiopia, Syria and Phoenicia, but his career was without national or political significance. Consult Breasted, J. H., ‘History of the Ancient Egyptians’ (New York 1906).

THOU, too, Jacques Auguste de (in Latin, THUMANUS), French magistrate and historian. b. Paris, 8 Oct. 1553; d. 7 May 1617. On the revolt of Paris, produced by the violence of the League, he adhered to Henry III, and after the assassination of the Duke of Guise, was principally instrumental in reconciling Henry with the king of Navarre. In 1595 he succeeded his uncle as chief justice, and immediately registered in anticipation of the Edict of Nantes, which he assisted in preparing, the Edict of Saint Germans in favor of the Protestants. In the regency of Mary de Medici he was appointed one of the directors-general of finance, and otherwise employed in nice and difficult matters, in which he was conspicuous for integrity and ability. His greatest literary labor was the composition in Latin of a luminous ‘Historia sui Temporis,’ of which the first part appeared in 1604. When finished it consisted of 1,38 books, comprising events from 1545 to 1607. It is remarkable for general impartiality. To this he added ‘Commentaries,’ or memoirs of his time, composed in the same spirit. The most complete edition of the history is that published in London in 1733, by Buckley, in seven volumes. Consult Collinson, ‘Life of Thuanus, with an Account of his Writings’ (1807).
THOUGHT — THRACE

THOUGHT, a cognitive relation other than direct awareness, born by the either toward an object which is believed to, toward objects capable of existence, as a universal, concerning which the on of existence has no meaning. This feature distinguishes thought from ination in the narrower sense which is ed toward objects capable of existence, ut involving any belief in their existence. it differs from mere presentation, the rt-relation, so far as it furnishes us with knowledge of its objects, furnishes us what Bertrand Russell calls knowledge by onon — knowledge that is, which may be ed by propositions. On this account ut can be conveyed by language, for lan- though totally unable to transmit an inate presentation, is well adapted as a e for the relations between propositions, bodied in propositions. This intimate as- to between thought and language leads e nominalist identification of the two, possesses all the defects inherent in form of nominalism (q.v.). A more s form of this nominalism pervades a part of the modern psychology of real and consists in the recognition in the f life of nothing but particulars. The mental method of psychology is, of, introspection. Now, the psychologist e his training in introspection in the n of the senses. Here introspection s for the most part the formation of an ory of the sense-data constituting a given nce. The psychologist consequently e the tendency to consider the analysis consciousness complete when all the mental of the level of sense-data are checked. id tagged. When he approaches an act ought, or the consciousness of a universal, y similar experience, he is likely to find mental states as he is accustomed to x, entirely absent, except for a few vague al organic or kinesthetic sensations and images. He, therefore, identifies these the thought-consciousness or universal- ousness and either concludes that these of consciousness add to the mind constituents not already found isation, memory, imagination and feeling, ulates the existence of some substantive al state not involving images or emotions. e to explain how such a barren mental can be so pregnant with meaning, he has e to such unexplanatory phrases as "con- attitudes." The true reason for the f of a vague picture of a particular tri to convey the entire meaning of triangu- or for power of a verbal image of the f gravitation to symbolize the law itself, t the mind is a structure and no struc- s exhausted by its inventory. ere is no doubt on earth that whether the stency or the correspondence theory of be valid, a necessary condition of true ng is that the pattern of thought should work. The general agreement of two ns agree, we do not have the relations e parts of one pattern symbolized by the of the other, but precisely by the rela- between those parts. Accordingly, it is reasonable to suppose that relations are conveyed in the mind, not by items, but by relations; that qualities are conveyed by qualities; that facts are conveyed by facts. The muscular strain in the orbits that may be the only substantive state in my mind when I think of a certain mathematical theorem is not my consciousness of that theorem, but merely a sort of a mental chalk-mark with which I make myself aware of my reference to the theorem. To call my true consciousness of the theorem either imageful or imageless involves a gross confusion of categories. (See Logic; Meaning; Psychology). Consult James, W. Principles of Psychology (New York 1890); Messer, A., Empfindung und Denken (Leipzig 1908); Psychologie (Stuttgart 1904); Ogden, R. M., Introduction to General Psychology (New York 1910); Titchener, E. B., Experimental Psychology of the Thought-Proceses (New York 1909).

THOUGHT TRANSFERENCE. See Telepathy.

THOUSAND ISLANDS, a group of islands in the Saint Lawrence River (q.v.), near Lake Ontario. For about 40 miles east of Ontario the Saint Lawrence has a width of three to seven miles and here there are seven large and 1,600 small islands. The belt of Laurentian gneiss which extends from the Adirondacks in New York into Canada is here crossed by the Saint Lawrence River. The crystalline rock and glacial deposit forming the river bed presents an uneven surface; some of the points being above the water form islands. A large number of the islands belong to Canada, the others to the State of New York. Hand-some summer residences have been erected on many of the islands and large hotels furnish accommodations for the many city people who visit the place each summer.


THRACE, thrâs, anciently a part of the Balkan Peninsula, whose territory was somewhat indefinite, but which comprised the region north of Macedonia, including Scythia. Its territory was understood differently at different times by the ancients, but was later limited to the country between the northern boundary of Macedonia and the Danube and that which lies between the Black Sea, the Bosporus, the Propontis and the Hellespont, the Aegean Sea and the Strymon River. The Balkans divided it into two parts — the Romans recognized only the southern division as Thrace. The land was inhabited by wild tribes, abounded in mines, had fertile lands and produced celebrated horses. The chief mountains were the Haemus (Balkan), Rhodope and Pangaenos. The largest river, the Hebrus or Maritza. The chief towns, Abdara where Democritus was born; Sestos and Byzantium. The mythological founders of Greek poetry, music and philosophy are supposed to have come from Thrace. The Thracians were classed as barbarians up to about 475 B.C., when Xerxes invaded the country and introduced the art and introduced the art of the Greeks. Some authorities believe that the Thracians agreed to have Philip of Macedon in the 4th century occupied a portion of the territory, and in 133 B.C. it came under the power of Rome. Native kings maintained a nominal rule, however, for several centuries. About 335 a.d.
Constantine sent a colony of Sarmatians to Thrace and continued to colonize the country. A few years later Thrace was overrun by the Goths and later by Attila and his Huns. In the following centuries a Bulgarian population developed, and about 1450 the country came under Turkish rule. For modern history see BULGARIA; BALKAN PENINSULA; SERBIA.

The Thracians can hardly be regarded as a distinct race, being a mixed people much confused with the Illyrians. The early tribes were low in morals and addicted to phallic worship. Their dialects were closely allied to the Greek. The native deities were Ares, Bendis and Dionysius. See ILLYRIA.

THRASHER, one of the large, thrush-like wrens of the American genus Hydrochus, of which the familiar Eastern species is the brown thrasher (H. rubecula), one of the most pleasing of American migratory birds. It is about 10 to 12 inches in length, slender, with a long bill and tail, rufous upper parts and a cream-white breast sharply marked with darker streaks. A frequent visitor to orchard and shade-trees, it is as likely to make its nest on the ground or upon bush-piles near the house as at the edge of the woods, and its oblong pepper-and-salt sprinkled eggs are familiar to every country boy. The thrasher in spring utters a highly varied song, so brilliant and full of startling phrases of melody and apparent mimicry that it fairly rivals the performance of the mocking-bird itself. While it eats some grain, it is tolerated because it is destructive to various grasshoppers, worms and bugs. The genus contains several other well-marked and interesting species of the West and Southwest. Consult Coues, 'Birds of the Southwest' (Washington 1879); Forshush, E. H., 'Useful Birds' (Boston 1913) and ornithologies of the United States generally.

THRASYBULUS, thra-sta-bu-lu's, Athenian general and democratic leader; d. about 390 B.C. He was a friend of Alcibiades, whose recall from exile he obtained. In 411 B.C. he commanded a galley in the fleet at Samos, joined in the opposition to the oligarchy of the Four Hundred, and exiled and excommunicated the Athenians in the fleet to uphold democratic government. At the battle of Cynossema he commanded the right wing and secured the victory by a sudden attack upon the Peloponnesians. In 407 B.C., with a fleet of 30 ships, he reduced most of the revolted cities on the coast of Thrace to submission and about one of the new generals. Banished on the establishment of the Thirty Tyrants, he seized, with the aid of some Thracians, the fortress of Phylae and with increased force occupied the Piraeus. After the accession of the Ten he was defeated by Lyons and Lybia, but, together with all who had joined him, was saved from punishment by the contrivance of Pausanias. In 395 B.C. he led an army to the assistance of the Thracians, then menaced by Sparta, and five years later was sent with 40 ships to aid the Rhodians against Tarentum, restored the Athenian焙lote (134 L.). By negotiating new alliances and reduced Methymna and other towns in Lesbos. Afterward sailing south, he anchored at the Pirymenon, near Aspendus in Pamphylia, when the inhabitants, exasperated by some act of his soldiers, fell upon him in the night and killed him.

THREAD. The filaments of fibrous substances spun out for weaving are in a general sense called threads, the specific name of such filaments being yarn. Thread as a specimen consists of two or more filaments of yarn twisted together for greater strength; when the filaments do not exceed two this is called doubling and the manufacturing process is doubling and twisting. Doubled yarn or thread is used in some sorts of weaving, especially in that called bobbin net, but its principal use is for sewing. When manufactured for the purpose it is specifically known as sewing thread. A large proportion of sewing thread is simply doubled yarn and the processes of yarn doubling and of the manufacture of sewing thread are substantially the same, but for sewing purposes often requires to be stronger and firmer in texture than doubled yarn and then three, four and six strands of yarn of fineness proportioned to the thickness of the thread required are used to produce it. The manufacture of sewing thread in the United States is very extensive. The chief seat of the cotton thread manufacture in Scotland is Paisley; in England, Manchester. Linen thread is manufactured largely in Ireland. Cotton was first used in the manufacture of sewing thread at Pawtucket, R. I., by Samuel Salter in 1794. Flax has been made everywhere, but as Mrs. Salter was spinning cotton she noticed the fineness of the fibre and at once conceived that it would make smooth thread. The idea was put into practice. The operation of spinning cotton is really making thread for weaving. A loose cotton called a "roving" is drawn out into a filament or yarn and twisted and wound on bobbins that later go to the weaving machine. See COTTON MANUFACTURES IN THE UNITED STATES.

THREADCELLS. See NEMATOCYSTS.

THREADNEEDLE STREET, London, England, the short thoroughfare faced by the Bank of England, which is proverbially called "The Old Lady of Threadneedle Street." The name is supposed to be derived from the three needles on the coat-of-arms of the Needlemakers' Guild.

THREADWORM, a common name often used for any of the Nematoidea (q.v.). It is distinctly inappropriate when applied to the thick fleshly species like Aercris and belongs properly to filiform nematodes, especially the filariae. In medical usage the term ordinarily designates the pinworm (Oxyurus) or the whipworm (Trichuris), common intestinal parasites of man. See ROUNDWORMS.

THREAT is defined in law as a menace of destruction or injury to the lives or property of those against whom it is made and may be the subject of a civil action for damages or frequently an equitable action may be maintained to restrain threats and intimidations. One who is induced by threats to enter into an agreement, pay money, surrender, and perform other act, when in itself is lawful, may by proper means avoid the consequences of such act, same having been performed under duress. One who threatens
another a bodily harm or to take the life
other may be required to give bond to
be peace; to threaten a court, or any-
der its immediate protection, is punish-
nd in some jurisdictions to obtain a pe-
advantage by threat is a punishable
as is also a threat to accuse one of a
for the purpose of obtaining money. In
of the United States the offense of
threatening letters for the purpose of
ng money is punishable and it is con-
the possession of the United States
l upon the outside of any mailable mat-
y printed or written threatening lan-
and one is punishable who assists know-
forward threatening letters. See
MAIL; CORRUPT PRACTICES ACTS.

REE-COLOR PROCESS. See Color-
NG; PRINTING; ENGRAVINGS.

REE FATES, The. See Norns.

REE HOURS' AGONY, or THREE
S' SERVICE, a devotion practised on
Friday, from noon till 3 o'clock in the
Catholic and some Protestant Episcopal
in commemoration of the Passion. It
roduced by Father Mestia, S.J., of Lima,
730, and reached the United States
cced into the English Church about 1865
as rendered legal by the Act of Uni-
; Amendment Act (1872), which per-
ditional services, consisting of any pray-
the Liturgy or Bible, with address or
and hymns.

REE KINGS, the men who came from
st to adore the Infant Jesus (Matt. ii,
They are probably called kings from
xii), 10, which verse is used in the serv-
Epiphany. They brought offerings of
'land, frankincense, and myrrh, and accord-
tion their names were Gaspar, Melchior
thasas. On their return to the East
vived baptism. The Empress Helena
to have brought their homes to Con-
oble, where they were removed to Mi-
d afterward to Cologne. In the chapel
Three Kings, built by the Emperor
ian (1459-1519), in Cologne Cathedral,
bibited their crowns and the shrine is
2d to retain their relics.

REE-MILE LIMIT. See Interna-
LAW.

REE MUSKETEERS, The. If a vote
ken in Europe and America as to the
storical romance ever penned there can
 doubt that it would favor 'The Three
ers' ('Les trois Mousquetaires'), of dre Dumas. Published in 1844, just
ecades after 'Waverley,' this work ex-
ed Scott's theory of the historical nov-
ection. It focussed interest upon cer-
figures whose fate was linked with
facts, personalities, and great move-
of a bygone day. Unlike the fictions
ott, however, it freely ordered and
 the facts of history, implying the
er's emancipation from reality and
'to shape his story at will so long as
ld reflect in general the spirit of the
represented. Dumas had read the
res M. d'Artagnan, by Gatien
de Sandras (Cologne, 1701-02). His
ition thus incited, played over the pe-
period of Richelieu's ascendency, and with un-
flagging verve and brilliance he described what
might have happened to a more courageous
and chivalrous d'Artagnan caught in the
counter-currents of amorous and political
trigue in 1628.

The plot turns upon the enmity between
the queen of Louis XIII and his Minister,
Richelieu. The latter seeks to control the
queen through his knowledge of her love for Buck-
ingham, attested by her bestowal upon the
ng lord of certain diamonds, the gift of her
husband. Richelieu, for his own ends, arouses
the jealousy of the king, who demands that the
queen wear the diamonds at a state ball. It
behooves the queen, therefore, to recover the
gems in all haste, and the difficult mission is
undertaken by d'Artagnan and his gallant
friends, the three guardsmen. After encoun-
tering well-nigh insuperable obstacles d'Artag-
nan succeeds, but he incurs the enmity of
Richelieu's most dangerous agent, Milady Cha-
ri. He falls enamored of her, yet escapes her
toils—assassination and poison—only to
learn that she is the cardinal's emissary sent
to England to threaten Buckingham with ex-
posure unless he will cease his efforts to aid
the besieged Huguenots in La Rochelle.
D'Artagnan and the musketeers, thereupon,
thwart Milady, who, languishing in prison, ere
long prevails upon her Puritan jailer to re-
lease her and to achieve the murder of Buck-
ingham. Then she contrives to poison d'Artag-
nan's sweetheart, but, pursued by the avenging
guardsmen, is overtaken and adjudged to suf-
fer death for her many crimes. Richelieu,
secretly pleased to be relieved of so wicked
an ally, pardons d'Artagnan and commissions
him a lieutenant of the musketeers.

From first to last, the romance moves at
a rapid pace in a world of passion and daring,
of hot blood and ready swords, of intrigue
and revenge, of jaunty heroism, of splendid
loyalty and of dauntless love and friendship.
It kicks up its heels, too, now and then, in
the mood of rollicking humor. For all its de-
partures from historic fact, it paints in vivid
colors a living picture of France in the 17th
century. Especially memorable are the
heroes. Though Milady prove the villain of melodrama
in petticoats, she is far from being a mere lay
figure; and Buckingham, Richelieu, the queen,
even the lackeys of d'Artagnan and the
musketeers, above all these gallant gentlemen
themselves, are vital creations. D'Artagnan,
the impetuous and generous Gascon, is well
matched by his friends, the shrill and dainty
Arams, the boastful and dandified Porthos,
and the melancholy Athos. It is small wonder
that the four should have enthralled the minds
of readers of every race and clime, and that
Dumas, yielding to popular demand, should have
continued their adventures in 'Twenty Years
After' (1845) and 'The Vicomte de Rete-
one' (1848-50). These sequels and 'The
Three Musketeers' are discussed in monographs
on Dumas, in French, by Glinel (1884), de
Bury (1885), Parigor (1902) and Lecomte
(1904), and in English, in Field (1873),
Spurr (1902) and Davidson (1902). The re-
ation of Dumas to Scott is made clear in
Louis Maugiron's 'Romantique historique en
France' (1898).

FRANK W. CHANDLER.
THREE-PHASE SYSTEM. See Electrical Terms.

THREE RIVERS, Canada, city, port of entry and county-seat of Saint Maurice County, Quebec, on the north bank of the Saint Lawrence River at its junction with the Saint Maurice, 90 miles below Montreal, 66 miles above Quebec and on the Canadian Pacific, and connected by ferry with the Grand Trunk Railway. By the French generally named Trois Rivieres. It has a large export trade in lumber and wood-pulp, the Shawanegan and other falls of the Saint Maurice being extensively utilized as water power for these industries; a large iron works, and important manufactures of foundry products and machinery, and other manufactures. The Roman Catholic cathedral is an imposing structure; other handsome buildings are the bishop's palace, the college and several convents, schools, and churches. The city is lighted by gas and electric lights and has hotels, banks and semi-weekly and weekly newspapers. Three Rivers was founded by Champlain in 1634, and a battle was fought here, 8 June 1776, between the Americans and British. The former were outnumbered and defeated. Pop. 13,691.

THREE RIVERS, Mich., manufacturing town in Saint Joseph County, on the Michigan Central Railroad, and at the junction of the Saint Joseph, Portage and Rocky rivers. It has car-building shops, railroad-supply factories, manufactures marine engines, knit goods, tools and paper pulp, and has foundries and brass and iron works. There is a handsome Carnegie library. Pop. about 5,000.

THREE-WIRE SYSTEM. See Electrical Terms.

THREMMATOLOGY. A term proposed by Ray Lancaster (from the Greek thremma, a nursing), to cover the principles and practices connected with the improvement of domesticated animals and plants. It is derived from evolution in general in that its ultimate purpose is utilitarian. The breeder is interested in definite results, whereas nature is supposed to be indifferent to everything but the "survival of the fittest". In thremmatology it is not to make the creature "fit" the conditions of life, but rather to bring both the creature and conditions to harmonize with the highest needs and purposes of man.

This brings to the surface in thremmatology, as a question of prime importance, one that is curious rather than otherwise in evolution, namely: Can the conditions of life be employed directly to influence deviation in the desired direction independently of selection; in other words, can individual modification become hereditary, or as the expression goes in general evolution, are acquired characters inherited?

All students agree that the development of individuals is strongly modified by the conditions of life, that is, the environment. Out in nature if these modifications are not inherited it implies only a little more work for selection, and the final result is the same whether this act is applied or not. The answer to the question is interesting, therefore, rather than vital, as the study is confined to general evolution but in thremmatology the answer involves a vital principle because the breeders, especially of animals, cannot afford unlimited selection. All the animals represent money, the owner is interested in getting results and a minimum destruction of values. He is interested, too, in securing improvements rapidly as possible, because time is money and the necessity for selection is reduced, both important considerations on a business standpoint. Upon the answer to this question will depend the kind of soil and employed in plant breeding, the daily care, shelter, the amount and character of feed provided for breeding animals, as well as the quality of exercise and training where speed, intelligence are involved. That these are important in the development of the individual are agreed, but it is also necessary to be provided for breeding stock for the offspring.

Evolutionists in general are interested primarily in form, while the thremmatologist is concerned very largely, if not mainly, in function. The size or shape of the cow is of importance than her ability to produce certain amounts of feed into milk and do it economically. This faculty depends directly on the functional ability of a very limited part of the body and not so much upon the form of the horse. The ability of the horse to attain speed depends not only upon his conformation but quite as much upon the quality of the motor parts, whether active or sluggish, the mental make-up, whether well balanced or erratic. Functional activity is, therefore, much more interest in thremmatology than the general evolution, and functional variability recognized as one of the principal oppositions for improvement.

The systematic study of thremmatology covers the following topics:
1. A working knowledge of the theories and concepts of general evolution.
2. The kinds of variation; namely, positive, relating merely to size; meristic, to pattern; and functional, relating to activities.
3. Continuous variation in which all are presented for selection, and discrete variation in which some values seldom or never occur, as in the case of sports, in photography and as it is involved in the process of orthogenesis.
4. The causes of variation, first, as between different individuals of the same general second, as between different individuals of the same parentage but of different genera, third, as between different individuals of the same parentage and the same general species, representing different generations, fourth, as between succeeding generations of the same species, representing different races; fifth, modifications in the individual during its development, plainly due to deviations of life, rather than to heredity, different uses of the term variation being kept distinctly in mind, so that it is permissible to use the word "deviation" for the former and "modification" for the fifth form of variation usually called variation. These are subdivided into two groups; first, selective
ions touching the basis of selection; secrecy environment, raising all questions of extent of the conditions of life, acclimation, and the inheritance of modifications or characters.

Statistical studies of heredity in order to act the array, eliminate chance, determine the laws of regression and pangen and the relative influence of parents. Correlation, as determined by correlation and useful as indexes of valuable characters.

The practical selection of breeders achieved by a full appreciation of the financessidersations involved, and the relation of performance and breeding powers as indicated by livestock records.

The testing of sires as a final basis of choice.

The importance of selecting for prolific among both animals and plants, and advantages of vigor and longevity.

The disturbing effect of fashion, and the methods of meeting its demands in breeders, and it is important in the study of this phase of the situation of the breeder in mind comprehensive ideas of general evolution that he be not a blind adherent of any r dogma, and that be free his mind from s of traditions that serve only to cloud judgment and deter progress. For example, has been held as a general principle that early planting is necessarily fatal to fecundity and produce, yet wheat, one of our most vigorous prolific crops, is systematically sown. The first lessons the breeder should therefore, is what is true of one is not necessarily true of all species.

at has been accomplished by way of increase, and it is much, has been gained exclusively by selection, and under disadvantageous circumstances. For example, among animals and some plants, there are too few for the best selection and repeated attempt to establish a small high-class animals has been as often relative for the reason that numbers are too cheap material for proper selection to maintain the initial standard, to say nothing of improvement.

Well-nigh universal practice of using sires is fatal to the most rapid progress, such cases the selection has been made full development. Thus some of the specimens are accepted because preposited at an early age and many of the best scared which if given time to fully make would prove their right to exist. Practice among the better breeders extending toward larger numbers, better races of life, the selection of more animals, followed by an actual breeding struggle in smaller numbers of these that have their basis in utility, and an ideal standard that, once adopted, is self-sustaining, if at all, would be expected the most rapid progress has been made in those breeds or varieties of animals and plants in which practically all the individuals can be put to the performance test. For example, it is comparatively easy to get a record from a cow or a speed horse and to know what the one can do at the pail or the other on the track. On the other hand it is impossible to put a meat animal in a test without sacrificing the individual as a breeder. Accordingly breeders of beef cattle, swine and other meat-producing animals have been working somewhat in the dark and to relieve the situation many have felt obliged to sacrifice on the block some of their best bred animals in order to test their standard of selection and verify their methods of breeding.

The improvement of animals and plants is a difficult and often a money-losing enterprise, but it is fascinating because of what is possible. By breeding, the sugar content of beets has been increased from 3 or 4 per cent to 12 and even 20 or more per cent. Corn has been bred richer in nitrogen than is wheat, and its oil content is raised or lowered at will. So far as is known any character may be substantially improved and the upper limit of improvement has never yet been reached with any animal or plant.

Many plants, and some animals, have received little attention at the hands of the breeder, and have either become extinct or else exist among us with little or no improvement, except such as has naturally followed upon better general conditions. Conspicuous examples are clover and alfalfa among legumes; timothy and other non-grain producing grasses; asparagus, salsify and many other vegetables and most shade and ornamental trees.

Cats breed without attention and their variations do not, therefore, become fixed. The American bison was allowed to become extinct, but because he would not have become useful if carefully bred, but because he was too near like common cattle to repay the trouble of domestication. In the same way the common hen prevented the domestication of the prairie chicken, but fortunately no real rival stood in the way of that truly American bird, the turkey.

Thus has threemamotology lost much valuable material, but notwithstanding this there is yet at hand awaiting the attention of the master much that is full of undeveloped possibilities, and with the development of our knowledge of the principles underlying heredity and variation great improvements in methods of breeding may be confidently expected.

EUGENE Davenport.
Dean of the College of Agriculture, University of Illinois.

THRESHER SHARK, or FOX SHARK, a well-known shark (Alopius vulpes), with a short conical snout and less formidable jaws than the white shark. The upper lobe of the tail fin is very elongated, being nearly equal in length to the rest of the body, and is used as a weapon by which this shark is able to kill or disable many fishes in a school, when he rushes into the midst of the crowd and lays about him. Tail included, the thresher attains a length of 13 feet. It inhabits the Atlantic and the Mediterranean.
THRESHING MACHINES. See Farm Machinery.

THIRT, a stemless fleshy herb (*Statice armoria*) of the seacoasts of the world. It has tufted rosettes of linear leaves with no perceptible difference between blade and petiole and white, pink or purple five-parted flowers, with calyx lobes nearly or quite sessile in compact heads terminating an almost naked scape, and are subtended by brown, dry bracts, the two lowest reflexed, and partly united into a sheath. Thrift is otherwise known as sea-side or lady's dressing, and is occasionally cultivated for flower-borders.

THRING, Edward, English schoolmaster and author: b. Alford, Somersetshire, 29 Nov. 1821; d. 22 Oct. 1887. He was educated at Eton and King's College, Cambridge, and after taking holy orders and serving as curate at Gloucester and elsewhere, in 1853 was appointed head master of Uppingham School. From an institution run down in efficiency and reputation he made it one of the healthiest, best equipped and flourishing public schools of England. No schoolmaster since Arnold was more successful in imprinting on the characters of his pupils a high ideal of duty as the great end of life. His own earnestness and honesty, his firm discipline and stern denunciation of cowardice and wrong gave character and reputation to the school. Among his published works are 'Thoughts on Life Science' (1869); 'The Theory and Practice of Teaching' (1883); 'Uppingham Sermons' (1886); 'Poems and Translations' (1887); and 'Uppingham and School Life' (1887). Consult Parkin, 'A Memory of Edward Thring' (1898); Skrine, 'Uppingham by the Sea' (1878).

THRIPS, a genus of minute insects, order Hemiptera, suborder Homoptera, closely allied to the Aphidoidea. They are extremely agile and seem to leap rather than fly, whence the common name "leaf-hopper." They live on flowers, plants and under the bark of trees. *T. cercealum* is a common species, scarcely a line in length or in extent of wing, residing in the spathes of husks of cereals, especially wheat, to which it is most injurious.

THROAT, the front of the neck, including the structures below the chin and above the collarbone, and also, by an extended usage, the passage from the mouth to the stomach (fauces, pharynx and oesophagus), and the passage from the mouth to the lungs (larynx and trachea or windpipe), these being the passages for food and breath. The throat and its various structures are subject to many diseases, some of which are among the most difficult with which medicine has to deal. See Nose and Throat Diseases.

THROMBOSIS, the formation or development of a thrombus (q.v.) in the heart, blood-vessels, lymphatics or other ducts. It is essentially the coagulation of fibrinogen and is usually, indeed by some condition which retards the flow of the blood, lymph, etc., such as stasis or other structural change in the lining membrane of a vessel or the presence of some foreign body or some alteration in the constitution of the blood, lymph, etc. In the heart and arteries it seldom occurs unless their lining membranes are roughened or their interior is so much impaired that the blood is not forcibly and readily propelled on. It is most frequent in veins, where stagnation is naturally slow, and it rarely occurs in capillaries. The thrombus formed may dry into a leather-like substance, forming phleboliths (in veins) or soften and be absorbed or suppurate; or they may, as after the ligaturing of an artery, become the propelling power of the heart, as in marasmus and exhausting diseases and after a septic or bacterial infection of the blood. The symptoms of thrombosis are those of the arrest of circulation and differ according to the vessel affected. They include passive hyperemia, venous distention, swelling of adjacent parts, anasarca of an extremity, etc. The treatment varies according to the seat of the thrombus.

THROMBUS, in anatomy, a plug or mass of blood coagulated and formed in a vessel and partially or wholly obstructing its lumen. If it remains at its place of origin it is called a primary thrombus; if it grows beyond its original limits it is a detached thrombus; carried by the blood from a distant blood vessel and forced into a smaller one, obstructing the circulation it becomes an embolus. A thrombus consists of agglutinated fibrin entangled in its meshes and white blood-corpuscles or of coagulated red blood-corpuscles, in lymphatics, and the term thrombus is applied (milk thrombus), to an accumulation of curdled milk in a lacertaceous tube. Thrombi are designated by various names according to their color, causation, shape, etc. Thus a silent thrombus is one which contains no air or is composed of red blood that is not colored by red blood; traumatic, one resulting from an injury; infective, one occurring as the result of septic or bacterial poisoning; annular, one which has an opening in its centre, the circumference being attached to the wall of the vessel; and membrane, one whose substance is disposed in layers, may differ in material. Thrombi, if remaining at the point of origin, may cause no harm, but they are liable to be carried away and to become dangerous in the vessels they block up the lumen of a vessel, with rise to pain and swelling and to loss of function in parts of the body more or less affected. See Thrombosis.

THRONE, a chair of state or superior rank, occupied by a sovereign, bishop or minister. The modern throne is usually a raised arm-chair of great size, raised on a pedestal and covered with a canopy, more or less ornamented. Anciently the throne was wooden; its design of marble, decora- tions of precious stones, and was frequently surmounted by pillar- or figures representing .

THROOP, Enos Thompson, 2nd governor and diplomat, b. John X., N. Y., 21 Aug. 1874; d. Auburn, N. Y., 1874. He studied law at Albany and there began a life-long friendship with Van Buren. He took up practice of Auburn in 1807 where he soon entered.
postmaster and county clerk. He was a member of Congress in 1814 and in pointed circuit judge. It fell to his lot he Morgan abduction case and his serv- tice was called to the bar. When urgent request, he resigned to his name to be placed on the State with Van Buren in 1828 and on the becoming Secretary of State to Presi- dent Polk in 1841, Throop became a and was re-elected the following year as naval officer at the port of ofr, 1833–38, when he was sent by Presi- dence of Burens as chargé-d'affaires to the n of the Two Sicilies (Naples). Re- ceived this post on the election of Harri- spent two years at Paris and then re- moved to private life. From 1847 to brought a farm of 800 acres at Kala- Mich, to high cultivation. In the lat- he retired from activity to his former- ce. Willowbrook, Auburn, N. Y., were s nephew, E. T. Throop Martin, and he shared the friendship of Secretary and entertained such prominent visitors hington Irving, Jenny Lind and mem- ters of the liberal arts and sciences. ROOF, Montgomery Hunt, American b, Auburn, N. Y., 26 Jan. 1877; d. N. Y., 11 Sept. 1892. He was educated at Union College in 1846; was admitted to the bar in 1848 and practised in Utica with his father (1854–56), and with Roseoe- g (1856–64). He removed to New used his influence in the State legislature and was appointed commis- sioner of the State to revise the Code Procedure (1877) and removed to in 1880 to devote himself to the publi- cation of books. He published 'The political Essay' (1864); 'The of Verbal Arguments' (1870); 'The of the Supreme Judicial Court of uscetts' (1887); 'Revised Statutes of the State' (1888).

ROOF, Pa., borough in Lackawanna near Scranton, and served by the New Jersey and Western and the Delaware, and several Western railroads. Coal-min- ing is the chief industry and there is also a silk operation. Pop. 5,133.

ROOF (troop) POLYTECHNIC IN- TE, located at Pasadena, Cal. It was in 1891 by Amos G. Throop to provide and practical education for both sexes, irely non-sectarian, the charter provides a majority of the trustees "shall not o any one religious denomination." Its tion comprises five schools: (1) the r school; (2) the academy; (3) the rial school; (4) the normal school; (5) ge. The academy offers three courses, literary and scientific; and the col- cource, courses, in engineering, electrical in, and mechanical science, all leading to the B.S. Some courses in each are required, and some elective. But the grammar and high school manual training is a regular part of curriculum; instruction is given in wood sloyd, carpentry, forge work, machine- work, clay modeling, mechanical and free- hand drawing, sewing and domestic science. The commercial school provides a two years' course; and the normal school three two years' courses in manual training, domestic economy, and in drawing are described in the description which include psychology, pedagogy and his- tory of education. There is also a summer school of art and manual training, designed mainly for teachers; work done in this school is credited toward a normal diploma. The in- stitute (1904) occupies two buildings, Poly- technic Hall and East Hall. The library in 1917 contained 7,000 volumes; and the Pasadena Public Library is also open to students. The productive funds amounted to $100,000, the students numbered 154 and the instructors 38.

THROSTE, a Scotch name, like "mavis", for the British song-thrush (q.v.).

THRUSH, a bird of the passerine family Turdidae, a family which contains some of the most familiar and attractive birds, and most of the best songsters of the world. They are predominantly migratory. A few are only five or six inches in length, but the American robin (q.v.), eight inches is a typical form; and most of them are of pleasing form and pleasingly but not gaudily colored. The thrushes are divisible into five subfamilies. The thrushes proper (Turdinae) are represented by such familiar forms as the American bluebird, robin, wood thrush, northern hermit and olive-backed thrushes, noted for their rich melodious songs, the English blackbird, song thrush, missel thrush and fieldfare, besides the nightingale, robin-red breast, hedgesparrow and many related forms in other parts of the world, most of which are elsewhere described under their names. Three American thrushes of this group call for brief mention, namely, the hermit thrush (Hylocichla guttata), which is migratory through the Eastern States, breeding in the far north, and is noted for its beautiful song, which has been said to express "serene religious beatitude"; the olive-back or Swain- son's thrush (Hylocichla mustelata), distinguished by the olive tint of its upper parts, and also a sweet-voiced emigrant to Europe, is the tawny thrush (see Vehr). In all of these the young are spotted, although the adults may be uniformly colored.

The second subfamily is composed of the genera Myioborus and Cichlipsis. The third contains the Old World warblers (Sylvinae), fantails, kinglets (sylviinae), and the like; the fourth (Poliolopitinae), the gnat-catchers (porellinae), and the fifth (Miminae), the mocking-birds, thrushers (q.v.), and related forms, many of which seem to imitate other birds, composing their own songs out of a medley of other notes, although the report of this tendency has usually been exaggerated; this last subfamily is by the most modern ornithologists separated from the thrushes and put with the wrens. Consult Evans, 'Birds' (New York 1901).

THRUSH, a form of parasitic stomatitis, due to the presence in the mouth of the thrush-fungus, white-moutre or sprue. (See MOUTH). The disease usually occurs in infants, but may appear later in life, even in old age, in association with some severe acute illness or some wasting disease, as pulmonary tuberculosis. The patches of thrush (techni-
THRYSTH—Thucydides

cally aphthae) are most commonly found on the dorsum and edges of the tongue, on the hard palate and on the inside of the lips and cheeks. The eruption is usually tender. The fungus may enter and even be formed in a healthy mouth, it will not flourish there. Inflammation or other abnormal condition of the mucous surface, and acid secretions, cause it to grow and develop. Thrush may be propagated from one babc to another through an infected nipple of a nurse, or by means of infected spoons, feeding-bottles, teats, etc. Usually the mucous membrane of the mouth underlying the fungous patches is of a bright or livid red, but when the system of the patient is much deteriorated, and the mycelium has penetrated deeply, shallow ulcerations may result. Sometimes the fungus of thrush is found in the pharynx, in the trachea, bronchi, and other places.

Of itself thrush is not dangerous, but it is usually significant of a deteriorated state of health, even in apparently healthy children, it lasts but a few days; in children having gastro-intestinal catarrh and diarrhoea, and who are much debilitated, it may last for weeks, fresh spots appearing as others vanish. The redness and excretion around the anus and adjacent skin of infants so affected is vulgarly regarded as an indication that the "thrush has run through the patient," and if the mouth condition has improved it is considered a favorable sign. While the thrush-fungus has been found in the esophagus, and even lower in the alimentary canal, there is no reason to believe that it is the cause of the redness and excoriation above referred to, which are rather due to a superficial dermatitis resulting from an excess of starchy food and a vitiated blood state.

Strict attention to diet is necessary in treatment; diminish the amount of sugar and starchy food, and give milk and lime-water. The mouth must be kept clean, and the chance of action of acid or alkali fluids, such as lime water or Vichy, a solution of borax and glacialic acid, or of sulphate of sodium, should be frequently sprayed upon the patches or applied with the fingers, covered with soft cloth. The general health is to be maintained by tonics, hygienic measures and relief of debilitating ailments.

THRESH, in veterinary surgery, a diseased condition of the frog of the horse's foot appearing as a severe and acute inflammation, which usually proceeds to ulceration, and which is accompanied by a fetid discharge. It is most frequently seen in horses of unsound constitution, and especially appears in stables where drainage and cleanliness are deficient. The best application for it is mineral tar. Calomel dressing is to be substituted for the tar in other cases. Administering in doses, and ulcerated and loose parts of the frog are to be carefully removed. Consult "Report on Diseases of the Horse" (United States Bureau of Animal Industry, Washington, D.C.).

THRUSS FAULT. See Fault.

THRUSTON, Lucy Meacham, American novelist: b. King and Queen County, Va., 20 March 1862. She was graduated from the Maryland State Normal School in 1880, and was married to Julius Thruston in 1884. She has published 'Mistress Betsy,' a novel; 'A Month in Virginia' (1902); 'Jack and His Island' (1902); 'Where the Tide Comes In' (1904); 'Called to the Field' (1906); 'Jenifer' (1907); 'The Heavens of the Unexpected' (1910).
THUGS — THUMAN

ch of history, and his work has been the "Statesman's Handbook." It is to be expected and impartiality, his judg-
ment he owed the power of producing a
which should be, as he himself said, a
on for posterity. Among the most val-
ditions of Thucydides are those of
(3 vols., Berlin 1825—26; Classen: 8 vols.,
1862-78); Poppo (1821—39); Rückert (1837—39);
Wähler 4). There are English translations by
John Classical Library), and Benjamin
(with introduction and historical notes,
London 1881; Boston 1883). Consult
Consult.

JGS, or THAGS, a vast fraternity of
ators that formerly existed in India until
ish and Persians and frequently underook to crush it
early 30 of the 19th century. The
ners of Thuggee claimed to be a
sect devoted to the goddess Kali, or
r Bhowanee, as she was indifferently
Composed of Mohammedans and
mostly the former—the Thugs com-
berby with assassination; they strangled
tims and interred the bodies. They
in companies of from two to 200,
outs, "inveiglers," apprentices and pro-
strangers. Some believe that
ition dates back to the days of Alex-
r even Xerxes; but more probably it
ed with the wild camp-followers and
ators who followed the Moslem armies of

They were first employed as scouts,
Sextons, then as seamen or holders of
, and lastly as Bhowotes or Burkas.
vice became a chiefa or disciple to a
jest of the cult, a gooroo, who con-
he rank or ordination upon the quali-
dent. The Thugs traveled along the
aders or pilgrims, or as Sepoys seek-
ether. Sometimes one number figured as a rajah with a large
of followers. Scouts gathered informa-
t travelers, and "inveiglers" wormed
into the confidence of their intended
The crimes were usually committed
were encamped, and two Thugs were
d to each person to be murdered. Oc-
have been known where as many as 60
were strangled in one party. The rules
Thugs forbad the killing of women,
musicians, dancers, sweepers, oil-
carpenters, blacksmiths, maided and
persons, and Ganges water-carriers.
prohibitions, however, women were
ly strangled. They did not murder
people on account of investigations ac-
cd by punishment that would surely
This circumstance accounts for the fact
ough Thuggee was known to exist in
century, it was not partially unbrailed
At the time there were at
0 Thugs plying their hideous trade;
 natives vanished annually, leaving
behind. In the midst of this reign of
savior suddenly appeared in the per-
son of Captain (afterward Maj.-Gen. Sir Wil-
liam) Sleeman, a junior official in the service
of the East India Company. He began Thug-
hunting in 1830, with the title of "General
Superintendent of Operations against Thuggee,"
conferred on him by Lord William Bentinck.
An Irishman, Molony, had captured a roving
band of 115 Thugs in 1823, while another gang
was seized in 1826. Within five years Sleeman
had thousands of them in prison; 20 Thugs
confessed to him that they had participated in
5,120 murders; one, Buhram, who had been a
strangler for 40 years, had 931 murders to his
discredit; Ramzan had 604, and Fatty Khan
508. Sleeman broke the back of the organiza-
tion. Up to October 1835 no fewer than 1,562
Thugs had been committed; 382 were hanged
and 986 transported or imprisoned for life.
As

HENRI F. KLEIN,
Editorial Staff Of The American.

THULE, thül'e (Greek, ðtholj), a name
given by the ancients to an island or group of
islands in the ocean to the northwest of Europe.
It was thought to be the northernmost inhabited
region of the earth. It is believed to have been
the Shetland Islands, though some have
identified it with Iceland, and others with both
Norway and Jutland. The term "ultima
Thule" was used by the Romans whenever
reference was made to the furthest distant
unknown land.

THULITE, a rose-pink variety of the
mineral zoisite (q.v.).

THULSTRUP, Thure de, American artist:
b. Sweden, 1848. Graduated from the National
Military Academy at Stockholm, he entered the
Swedish army in 1865; served in the Franco-
Prussian War and was present at both battles of
Lyons. He served also in Algeria as an officer
in the French army. After studying
drawing in Paris he went to Canada, later com-
ing to the United States. In 1872 he joined the
staff of the Graphic as illustrator; was con-
ected with the Frank Leslie publishing house
in the same capacity from 1876 to 1880; when
he entered the employ of Harper Brothers. He
is especially well known as a military and his-
torical illustrator.

THUMAN, too'män, Paul, German
1834; d. 1905. He represented a student at the
Academy of Berlin from 1853 to 1855 and sub-
sequently worked under Julius Hubner in
Dresden till the year 1860. At Weimar he stud-
ied with Ferdinand Pauwels and in 1866 was appointed professor in the art school of that city. From 1875 to 1887 he filled the duties of professor in the Art Academy of Berlin. He was mainly occupied in the illustration of Auerbach’s ‘Kalender’; Goethe’s ‘Dichtung und Wahrheit’; Tennyson’s ‘Enoch Arden’; Chamisso’s works; and Heine’s ‘Buch der Lieder,’ etc. His success in this work was due to the powerful drawing, thoughtfulness, and genuine feeling which characterized his style; yet latterly he lapsed into a certain sickly sentimentality and frivolity of treatment which injured the reputation won by his early productions. Among his paintings the best are five canvases which illustrate the life of Luther, executed for the castle of Wartburg; ‘The Vision of St. Gertrude’; ‘The Bribe of Hermann from the Battle of Teutoburg Forest’; and ‘The Three Fates.’

THUN, Bern, Switzerland, (1) a lake in the canton of Bern, 10 miles long by two miles broad. Its surface is over 1,800 feet above sea-level and its greatest depth 712 feet. It forms the outlet of the Aar, which leaves it at the northwest. The lake is enclosed by gentle slopes, covered with villas and orchards, except beyond Sigriswil, where the north bank is more precipitous. The scenery is idyllic. Fish are plentiful, especially eels, carp, pike, etc. Steamers run from Thun to Interlaken, and an old road follows the coast toward the south, a new one toward the north. The important towns along the banks are Oberhofen (health resort), Spiez and Simmerthal. The first steam navigation of the lake was inaugurated in 1835. (2) The town of Thun in the canton of Bern is one mile distant, and is the station for travelers touring the Bernese Oberland. It is the principal military arsenal of Switzerland and here is located a military institution for army officers. The noteworthy buildings are the Gothic church and the old 12th century castle. The manufacture of bricks and pottery forms the main industry. Thun was the capital of the Oberland of the Helvetian Republic (1798–1802). Pop. 7,885.

THUNDER. See LIGHTNING AND LIGHTNING-RODS.

THUNDER-BIRD, an imaginary bird occurring in the mythology of races of low culture, and personifying thunder or its cause. Among the Caribs, Brazilians, Algonkins and various other North American Indians, and among the Karoos of Shiu, the South African Brehuaus and Basutos, and other aborigines, there are legends of a flapping or flashing thunder-bird, which seem to translate into myth the thought of thunder and lightning descending from the upper regions of the air, the home of the vulture and the vulture.

THUNDER CLOUD, Mohawk Indian chief and army scout; b. Canajoharie, Canada, about 1856; d. Rochester, N. Y., 1910. He became noted during the Indian troubles (1872–76) and rendered valuable assistance to the United States army, being one of those who had the chief Red Cloud. In civil life he became celebrated as an artist’s model and posed for the leading painters of Indians and Indian scenes. Frederick Remington used him frequently and he appears in various histori cal groups in the capital at Saint Paul, the work of Millet and others, head appears on the gold coin of the United States for which Victor Brenner selected profile.

THUNDERBOLT, The, a comedy, by Sir Arthur Wing Pinero, represents work of one of the most gifted contemporary English dramatists. In it are most of the theatrical ideas that constitute the common stock in the playwright’s craft and which he was to use with consummate ease and deftly. He modestly describes ‘The Thunderbolt’ as ‘The fun in the life of a rich family.’ We are introduced into a family conclave of the Edwardian era, the only member who has wealth, lies dead upstairs. He was a family man, although he had been estranged from his or her and sister for many years, his next of kin and presumably for, to their delight, surprise, he leaves his will to nor made any will whatever for the young woman who is to be his daughter and whose life has supported lavishly and affectionately. The reactions of the various members of the family to this situation as it develops are portrayed with a ruthless truth and simplicity that remind one of Balzac rather than of the work of ‘Sweet Lavender,’ ‘The Maestro’s Daughter,’ ‘The Second Mrs. Tanqueray.’ One influence of the conversational play is in Granville Barker but in ‘The Thunderbolt’ it is real talk of quite ordinary people, forwarding the movement of the drama, halting it for philosophical discussion or dilatory monologue. Pinero is so enamored of this new realistic method that he sacrifices the opportunity of an effective curtain and acts as a third act. The family is again in conflict, the thunderbolt has fallen, there is leaving everything to the daughter, Thaddeus, having just been forced to that it was his wife, not himself, who found and destroyed this will, then, in the room with a frantic but futile appeal to the family and the lawyers: ‘Oh, my God, I’m the one! Don’t you know she head! Don’t you touch her! A good wife to me!’ Instead of a scene on this poignant note, Pinero lingered to watch the exasperated family and lament over the money they see through their greedy fingers. But glibly, and petty as they are, the human, and James’ frank states, ‘The money really mean,’ reconciles one to the solution by all get a share, although Helen is perhaps the least natural thing. She is not a very appealing heroine, the other characters are people one it possible in real life. There is no interest, no sex problem, no fun, and action. In view of the lack of popular appeal it is not surprising. Thunderbolt’ has not been one of the conspicuously successful on the stage but the real lover of the drama and to the life, it is his most important play.‘
THUNDERING LEGION—THURLOE

THUNDERING LEGION. See Legion, Thundering.

THÜNEN, tü'n'en, Johann Heinrich von, an economist: b. Oldenburg, 1783; d. 1850. Received a thorough education in agriculture also studied art at Hanover 1810 he rented an estate in Mecklenburg-Schwerin, he developed into a model farm. He is now principally for the economic views, in 'Der isolirte Staat in Beziehung Landwirtschaft und Nationalökonomie' 1820-63. In this work he sets down: premises in regard to wages and land, action, markets, etc. His law of wages and favor among more recent economists. II. Paigrave, 'Dictionary of Political Economy' (3 vols., London 1899) and Schuer, H., 'J. H. von Thünen, ein Forscher' (2d ed., Rostock 1883).

THURBER, George, American naturalist: b. Providence, R. I., 2 Sept. 1821; ssaic, N. J., 2 April 1890. He was educated at the classical and engineering school at Rensselaer and became a pharmacist and a lec- onology, finally securing an appointment (1850) with the commission to settle the area between the United States and to. He made an important collection of birds and on his return to Providence was the degree of A.M. by Brown University, cured an appointment in the Assay Office at York, lectured on botany in Cooper and on botany and materia medica in New York College of Pharmacy. Later he was the chair of botany and horticultu- n the Michigan College of Agriculture but again to New York and to lecture at college of Pharmacy and finally became of the American Agriculturist for 24 In (1889) he was elected member of the Royal Horticultural Society, member of the American Pomological Society and corresponding mem- f the Philadelphia Academy. His collection of western plants is in the Gray Herb at Harvard.

THURGAU, tu'rgow, Switzerland, a canton, northeast, with an area of 381 square miles. Unlike most Swiss cantons it has no elevations, but a diversified surface, most high is productive. It belongs to the Basin and is chiefly watered by the Thur. There are extensive forests, and rable lands yield a limited amount of and potatoes and grapes—fruit is ant. Stock-raising and dairying are also important. Manufactures consist of linen and m cloth, ribbons, lace, hose, hosiery, muslin, and wooden articles. There is consid- trade, owing partly to Lake Constance and Rhine on its borders. The canton was reformed in 1798, although it had been in pos- of the Swiss from 1460. For nearly a year prior to that time it belonged to the of Hapsburg. The capital is Fravenfeld. of canton 140,540. See Switzerland.

THURIBLE. See Censer.

THURIFER, in Roman Catholic Church services, the attendant at High Mass, Solemn Vespers and Benediction, who uses the thurible, either by simply waving it to and fro or for incensing the clergy, choir and congregation, and who at certain times presents it to the officiating priest that he may incense the altar or the Host. Strictly speaking, the office of thurifer belongs to the acolyte, the highest of the four Minor Orders, but all the functions of the acolyte are now freely performed by laymen.

THURINGERWALD, tü'ring-er-walt, or FOREST OF THURINGIA, Germany, a series of mountain ranges centrally located, extending from the Werra near Eisenach southward as far as the valley of the Rodach. The ramifications toward the southeast and the west connect it with the Frankenwald and the Rhön Mountains. The highest elevations are found in the Grosser Beerberg (3,228 feet), and the Schneekopf (3,201 feet), west of Zelle. The entire mountain range is covered with evergreens and leafy trees and its slopes and valleys present charming landscape and views. The principal streams are the Gera, Wipper, Ilm and Schwarza, flowing into the Unstrut and Saale; the Rodach and Steinach and Itz; and the Werra with its affluents—the Hörsel and Leine. There are rich deposits of iron, copper, cobalt, lead and, in the neighborhood of Friedrichroda, ala- baster. The valleys and slopes are the home of an active industry, including porcelain factories, glass-works, wooden manufactures, especially toys, slate, meerschaum and other pipes, fire-arms and celebrated pottery. Thüringerwald is much frequented by tourists, and the transportation and other facilities are unsurpassed.

THURINGIA, Germany, territorial name still borne by that part of Upper Saxony generally bounded by the Werra, the Saale and the Harz Mountains, though it has no longer any political significance. It was once a much more extensive territory. The name was derived from the Thuringian tribe which occupied it in the 5th century. Much of its area is covered by the Thüringerwald (q.v.). Erfurt is the largest city. The region has had a chequered history, falling in turn to Thuringia, Franconia, and Carlowingan. It was in turn a kingdom, duchy and margrave. (See Saxe-Weimar.) Consult Devrient, Ernst, 'Thüringische Geschichten' (Leipzig 1907); Knobenhauer, Thomas, 'Ge- schichte Thüringens in der karolingischen und sächsischen Zeit' (Gotha 1863); 'Geschichte Thüringens zur Zeit des ersten Landgrafenhauses' (ib. 1871).

THURLOE, John, English statesman: b. Essex County, 12 June 1610; d. London, 21 Feb. 1668. He studied law, was admitted to Lincoln's Inn in 1647, and appointed to a government post in 1648. He took no part in the political events leading to the king's death. On 29 March 1652 he was appointed Secretary to the Council of State under Cromwell; and was also given control of the intelligence department, which duties he performed so remarkably well that it was said that the enemies of the Protector made no move without detection by Thurloe or his assistants. He stood high in Cromwell's regard and enjoyed his confidence to a greater extent than any other adviser. He served in the Parlia-
ments of 1654 and 1656, and was reappointed Secretary of Cromwell's Council of State in 1657. He became chancellor of Glasgow University in 1658. He supported Richard Cromwell's successor, the son of Oliver Cromwell, sat in the Parliament of 1659, continued prominent in government affairs and in 1660 was reappointed Secretary of the Council of State. After the Restoration he was arrested on a charge of high treason 13 March 1660, but was freed subject to attending the secretaries of state whenever they should require his services. His correspondence is in the Bodleian Library, Oxford, and is an important source of historical information. A part of it was published with a biographical sketch by T. Birch (1742).

THURLOW, thür'lō, Edward, Lorp, English lord-chancellor: b. Bracon Ash, Norfolk, 9 Dec. 1731; d. Brighton, Sussex, 12 Sept. 1806. He was educated at Caius College, Cambridge, subsequently entered the Middle Temple and in 1754 was called to the bar. In 1761 he was appointed the king's counsel, and was employed to prepare the evidence for the appeal in the great Douglas cause, which, however, did not come on for hearing in the House of Lords until 1768. In 1768 he was returned as member of Parliament for Tamworth, and became a constant supporter of Lord North's administration. In 1770 he was made solicitor-general, and Attorney-General in 1771. In 1778 he was appointed lord-chancellor, and raised to the peerage as Baron Thurloe. The personal favor of the king retained him in office during the Rockingham administration, whose measures he actively opposed, but he was compelled to resign on the dissolution of the ministry in 1783. He was still considered the confidential adviser of the king, and on the dissolution of the coalition ministry at the close of the year the great seal was restored to him by Pitt. In 1788 the king's illness rendered it necessary to consider the contingency of a regency and Pitt suspended Thurloe in intrigue with Prince of Wales. Thurloe then began publicly to oppose the measures of his colleagues, particularly Pitt's scheme for maintaining the sinking-fund, in the House of Lords, whereupon Pitt demanded his dismissal, to which the king at once agreed. Consult Campbell, 'Lives of the Chancellors'; Foss, 'Judges of England' (London 1848-64).

THURMAN, thür'man, Allen Granbery, American lawyer and politician: b. Lynchburg, Va., 13 Nov. 1813; d. Columbus, Ohio, 12 Dec. 1898. He was brought, in childhood, to Chillicothe, Ohio, and there received an academical education. After teaching for a time he studied law in the office of his uncle, William Allen (q.v.); in 1835 was admitted to the bar and forming a partnership with his uncle soon attained success as a practicing lawyer. At the same time that he began his legal career he became active in politics as a member of the Democratic party, but held no political office until 1841 when he was elected to Congress. He was one of the earnest supporters of the Union in the conflict in the Mexican War; though a Democrat and opposed to any change in the Missouri Compromise (q.v.), he, with the most of the Northern Democrats, voted for the Wilmot Proviso (q.v.), and replied to Southern criticism of this act in a speech railing, forcibly, the reasons of the North for opposing the extension of slave territory. At the close of his Congress term he resumed the practice of law, and in 1851 was elected one of the judges of the Ohio Supreme Court; here his learned and able decisions won him wide reputation as a jurist. When his term of office expired in 1856 he again took up the practice of his profession, this time in Columbus. He took no active part in politics until 1867, when he was nominated by the Democrats as governor of Ohio; he conducted a vigorous campaign, and though defeated by a small plurality, the Democratic party carried the legislature. In the next year he was elected to the United States Senate and re-elected in 1874. His ability in debate won him immediate recognition, and he was appointed a member of the Judiciary Committee, and became the leader of his party in the Senate; during his last term he was elected president pro tem. He favored a liberal policy of reconstruction, introduced the so-called Thurman Bill compelling the Pacific Railroad to comply with the acts of Congress for its franchise, and succeeded in effecting the passage of this bill against a powerful opposition. In 1876 he was a member of the Electoral Commission (q.v.), and steadfastly supported the claims of Tilden. He was a leader in the Democratic Presidential nomination in 1876, 1880 and 1884; in 1881 he was appointed a member of the Paris Monetary Conference. In 1888 he was the Democratic nominee for Vice-President and took active part in the campaign; after the defeat of his party in that year, he retired from political life. Consult Hensel and Parker, 'Lives and Public Services of Grover Cleveland and Allen G. Thurman' (Philadelphia 1892).

THURN, Henry Matthia, Count, Bohemian Protestant military leader: b. 1580; d. 2 Jan. 1640. He served in the Turkish War and for his services was made Burgrave of Karlstein, Bohemia, by Emperor Rudolph I; he was deprived of his estates, however, after he was named one of the Thirty Thousand of the Faith by the Bohemian estates. He was called to the Bohemian Protestant insurgents at the beginning of the Thirty Years' War in 1618; invaded Austria and unsuccessfully besieged Vienna in 1619; and was decisively defeated at White Hill in 1620. He afterward served in the Swedish army; and in 1632 fought under Wallenstein at the defeat of Lützen.

THURSDAY, the fifth day of the week, so called from the old Teutonic god of thunder, Thor, the northern Jupiter. The German name Donnerstag is of similar origin; and Thun, Donner, are equivalent to English thunder. Ascension-day is often called Holy Thursday.

THURSDAY ISLAND, Queensland, a small island in Torres Strait, 30 miles from Cape York. It has an excellent harbor. Port Kennedy, which is a port of call and trade depot. Pop. about 2,000.

THURSTON, John Mellen, American statesman: b. Newburyport, Vt., 21 Aug. 1847; d. Omaha, Neb., 9 Aug. 1916. His parents took him to Wisconsin, where he was educated in the public schools. He received his educa-
Wayland Academy at Beaver Dam, Wis., 1869 was admitted to the bar. Soon after he went to Omaha, Neb., where he most of his life. About 1873 he was a 1r of the city council and was city a of the United States Naval Academy, Nebraska legislature as a Republican and presidential elector in 1880. Soon after became counsel for the Union Pacific ad. In 1893 the Republican caucus nominated him for United States Senator, but he didn't go to Washington until 1895. He re- 1 until 1901. He seconded the nomina- 

of William McKinley for President in vacating the chair at that convention to From 1889 to 1891 he was president of residential Republican League. In 1901 he was a commissioner of the Saint Louis tion.

URSTON, Robert Henry, American er and educator, b. Providence, R. I., 25 August 1839; d. Ithaca, N. Y., 25 Oct. 1903. He accepted a position at Cornell University in 1859, received his mechanical training in his own engine-building shops. In 1861 he joined the army corps of the navy, served during the Civil War, was twice promoted, and in 1865 appointed assistant professor of natural philosophy at the United States Naval Academy. He resigned his commission in the navy, accepted the professorship of mechanical engineering at the Stevens Institute of Technology. He was appointed a member of the first scientific commission to the Exhibition in 1873, and in 1885 became rector of Sibley College, the engineering department of Cornell University, and university professor of mechanical engineering. The Sibley College curriculum is due to his ability as an organizer, and minimization made the college one of the most important engineering schools of the country. Invention he was known for his magazines, ahh and navySignal, various forms of testing machines, and other metals, and an engine-gov- ord and other improvements on the steam engine. In scientific research his most noteworthy work was done in investigating the steam-turbine, the development of the steam-engine, and certifying the useful qualities of various. His contributions to engineering and fic literature are also of value, being a rather clearness of statement unusual in the field. The most important of his publications are 'Materials of Engineering,' 1884; 'new ed., 1900; 'Manual of Steam Engine,' 1890-1902; 'Manual of Boilers,' 1888-1901; 'Engine and Fire,' 1899; 'History of the Engine,' 1878-1902. Others are 'Manual of Construction,' 1884; 'Materials of Construction,' 1890-1900; 'Stationary Engines,' 1885; 'Friction and Loss in Machinery and Mill Work,' 1885-93; 'Heat as a Form of Energy,' 1890; of Robert Fulton,' 1891; and numerous fic papers. Consult Durand, W. R., 'Henry Thurston,' (Washington 1904). IUSNELDA, wife of Arminius (q.v.), of the Cherusci, a German tribe which the Romans from the Elbe and the in 9 A.D. 14 A.D. the Roman legions again penetrated the German interior, and Thusnelda was taken captive to Rome by the Roman conqueror, Germanicus Cæsar (q.v.).

THWAITES, thi-wats, Reuben Gold, American historian and editor. b. Dorchester, Mass., 15 May 1853; d. 1913. He was educated at the high school of his native town and in 1874-75 took a postgraduate course at Yale. From 1876 to 1886 he was managing editor of the Wisconsin State Journal. He published 'Down Historic Waterways' (1888; rev. ed. 1902) 'The Story of Wisconsin' (1890); 'The Colonies, 1492-1750' (1891); 'Afloat on the Ohio' (1897); 'Daniel Boone' (1902); 'Father Marquette' (1902); 'Brief History of Rocky Mountain Exploration' (1904); 'France in America' (1905); 'School History of the United States' (1912). He also edited The Jesuit Relations (73 vols. 1896-1901); 'Original Journals of Lewis and Clark' (7 vols., 1905); 'Early Western Travels, 1748-1846' (32 vols., 1904-07), and other works. Consult Turner, F. J., 'Reuben Gold Thwaites' (Madison, Wis., 1914).

THWING, Charles Franklin, American college president. b. New Sharon, Me., 9 Nov. 1855. He was graduated at Harvard in 1876, and at Andover Theological Seminary in 1879; received the honorary degree of S.T.D., from Chicago Theological Seminary in 1889 L.L.D., from Marietta College in 1894, from Illinois College in 1894, from Waynesburg College in 1901, from Washington and Jefferson College in 1902, and from Kenyon College in 1910; was ordained Congregational minister in 1879; was pasteur of North Avenue Congregational Church in Cambridge, Mass., 1879-86, of Plymouth Church in Minneapolis, 1886-90, and president of Western Reserve University and Adelbert College since 1890. He is associate editor of Bibliotheca Sacra since 1884, secretary of the Carnegie Foundation for the Advancement of Teaching, and president of the Intercollegiate Peace Association. President Thwing is the author of American Colleges: Their Students and Work (1878); 'The Reading of Books' (1881); 'The Working Church' (1884); 'Within College Walls' (1894); 'The College Woman' (1894); 'The American College in American Life' (1900); 'College Administration' (1900); 'The Best Life' (1900); 'The Choice of a College' (1901); 'God in His World' (1902); 'The Youth's Dream of Life' (1902); 'If I were a College Student' (1902); 'A Liberal Education and a Liberal Faith' (1903); 'College Training and the Business Man' (1906); 'Higher Education in America, A History' (1906); 'Education in the Far East' (1909); 'History of Education in the United States since the Civil War' (1910); 'Universities of the World' (1911); 'Letters from a Father to His Son entering College' (1912); 'Letters from a Family to His Daughter entering College' (1913); 'The Co-ordinate System in the Higher Education' (1913); 'The Family: An Historical and Social Study' (1886 in collaboration with Carrie Butler Thwing, revised 1913); 'Education according to Some Modern Masters' (1916) and contributions to magazines.

THYESTES, thi-és-tez. See Atreus.
THYLACINE, an Anglization of the generic term Thylacinus given to the predatory marsupial called Tasmanian or zebra wolf, and described under Dasyure (q.v.).

THYME, one of the species of the labiate genus Thymus, small, shrubby, perennial herbs of the Old World, cultivated on account of their aromatic foliage as flavoring herbs, or for ornament. T. vulgaris, an erect, or somewhat decumbent plant, from one to two feet high, has sessile linear-lanceolate leaves with revolute margins. The pale-lilac flowers are small, and in interrupted spikes at the ends of the branches. Thyme has a very strong and pungent odor, and was formerly employed for seasoning. It is a favorite food of bees, and that of the Grecian hills produced the famous honey of Mount Hymettus. Another thyme, sometimes grown as a culinary herb, but more often to cover rock-work and waste places, is the creeping thyme or mother-of-thyme (T. serpyllum). Its internodes are short, so that the plant is very low, and in dense, broad tufts. One of its varieties (citriodorus), is the lemon-scented thyme. Oil of thyme is distilled from these plants, especially in France, where they are very abundant, and may be used in perfumery. The oil of the oil of origanum, and is of utility in veterinary practice. Thymol is a solid, acrid steartopene obtained from this oil, and is used, chiefly externally in alcoholic solution, for a stimulant and powerful antiseptic in the treatment of wounds and sores. Other labiates called thyme, from their aroma, are Calamintha anisata, and C. nepeta, the basil thyme, and C. clino-podium, the horse-thyme. The cat-thyme is the herb-mastic, or Teucrium marum, a powerful sterntatory, useful for its scent. Virginian thyme is Koelia virginiana.

THYME OIL, a volatile oil obtained by distilling the leaves and flowering tops of Thymus vulgaris, or garden thyme, with water. Colorless when pure, sparingly soluble in water, easily so in alcohol. It contains two hydrocarbons pinene, C_{10}H_{16}, and cymene, C_{10}H_{14}, as well as a phenol-like body thymol. Used in lotions and dressings as a stimulant and antiseptic.

THYMOL, in chemistry, C_{6}H_{5}O, a colorless crystalline compound obtained from the oil of thyme, horse mint, etc. Often called thyme camphor. Its chemical nature is analogous to that of phenol, or carbothic acid, though it has but little of the caustic properties of that body. It crystallizes in plates, is almost insoluble in water, soluble in alcohol, melts at 44° C., and is very easily attacked by many chemical agents. It has a very strong odor and is used as an antiseptic and disinfectant. Indine and caustic potash convert it into di-iodo-thymol, which is the well-known antiseptic aristol.

THYMEUS GLAND, one of the ductless glands, existing as a temporary organ, developed to its full size about the end of the second year of life and decreasing in size after that period. At puberty it almost or wholly disappears. At its full development it appears to consist of two lobes or halves, situated in the middle line, and placed partly in the neck, extending from the cartilage of the fourth rib upward as high as the inferior edge or border of the thyroid gland (q.v.). It is covered in front by the strap, and by the sternothyroid and sternothyroid muscles. It rests upon the pericardium or heart sac, and lies on the neck on the front and sides of the trachea or windpipe. This gland is of a lobulated appearance, and is of soft consistence. Its weight at birth is about half an ounce. Its microscopic structure exhibits a composition of lobules, each lobule being formed of regularly disposed masses of what is termed lymphoid tissue, consisting of a meshwork of exceedingly delicate connective tissue, the meshes being crowded with round cells identical with the white corpuscles of the blood and lymph corpuscles. The functions of the gland are still undetermined. It is placed in the same category as the thyroid gland and spleen; and the most probable theory as to its use is that which assigns to it the work of elaborating the elements of the blood, especially in the earlier years of life. It is generally believed to exert a strong influence on growth and development. It is employed in organotherapy (q.v.). The well-known 'sweatbread' is the thymus gland of a calf or lamb.

THYRIDOPTERYX, a genus of foliage-destroying insects. See BAGWORM.

THYROID GLAND, a structure having no outlet or duct, and classified with the spleen, thymus gland, and suprarenal capsules under the general name of ductless glands. In man the thyroid gland is situated at the upper part of the trachea or windpipe and consists of two halves or lobes, placed one on each side of the windpipe, and united by a narrow bridge of substance—the isthmus of the gland. It is covered in front by the muscles of the neck and its sides lie in contact with the common carotid artery. Its under surfaces embrace the windpipe and larynx. This gland is of a reddish color. It is larger in women than in men, and weighs, on an average, about one and one-half ounces. It may become enormously enlarged, as in goitre. Its structure consists of numerous small shut sacs, surrounded by a network of capillary blood vessels, or shut sac is lined internally by a single layer of columnar cells, and is filled with a viscid mucoid substance. The blood-vessels of the gland are derived from the superior and inferior thyroid arteries and its nerves come from the pneumogastric and sympathetic trunks. The use of this gland is not quite clear, but is generally held to be the production of a secretion which has a great influence on alimentation. Its business is connected with the maintenance of a proper quality of blood, either by the removal of certain effete substances from the blood, or by the addition of certain elements to it. Its complete extirpation or atrophy is attended with disease. The thyroid gland of the sheep is used in the treatment of myxedema, the complication resulting from the loss of function of the gland.

THYROID GLAND, Diseases of. Several varieties of enlargement have been noticed in the thyroid and are generally grouped under the general term goitre (q.v.). Myxedema is the present name given to the condition resulting from the loss of function either because of atrophy or of the excision of the organ. The thyroid gland of the
THYRSe—TIBER

is used in the preparation of an extract is efficacious in the relief of this condition.

See Creditism; Secretions, Internal;

York, thers, a form of inflorescence ting of a compact panicle in which the e branches are the longest, giving the an ovate shape. The primary pedicels entrical, and the secondary centrifugal.

YSANURA, an order of neuropteroid s. See Brisiletails.

AHUANACO, té-a-wa-nâ-kô, Bolivia, tins of a prehistoric city, near the south of Lake Titicaca, in lat. 16° 42′ S., long. 7° W., about 40 miles west of La Paz city. ruins stand on an eminence 12,930 feet sea-level, which, from the water marks d it, seems to have been formerly an in Lake Titicaca. The level of the lake ver, is now 135 feet lower, and its shores miles distant. This fact, in conjunction others, warrants the belief that these re- antedate any other known in America; indicate a different and higher order of an was found to exist at the time of the sh conquest, in any other part of that ent. The ancient Peruviens had the st traditions concerning them, believing he structures of which they are the re- were raised in remote ages, by giants, in de night. The chroniclers of the Spanis est have described them, and their ac- s do not differ materially from those of medieval. They are in a state of ex- dilapidation. Some of the structures to have been built on a pyramidal plan, have covered several acres; but the most kable features still remaining are mono- doorways, pillars and statues of stone, ately sculptured in a style wholly dif- from any other remains of art yet in America. One of these doorways is at 100 feet, with an opening yet four inches by three feet two inches, hewn cut from a single stone. Its east has a cornice in the centre of which is a figure of strange form, crowned with interspersed with serpents with crested.

On each side of this figure are rows of square compartments, filled with n and other figures, of apparently sym- design. The statues are broken, so that iticult to state their original dimensions; ise may be inferred from the size of the of one, which is four feet in length and portionate width. The whole neighborhood to be swarmed with vast blocks of stone clab- y wrought, some of which measure three n length by 18 feet in width, and six in thickness. Some of these stones have found to weigh as much as 400 tons and transported many miles. No mortar was in the masonry; stones grooved and ed were held together with clamps and n pins. Dressing and carving of stones lone with this, whilst the stones for the of the islands of Lake Titicaca are other nents, of great extent, but of true Peru- type, apparently the remains of temples yed on the arrival of the Spaniards.

At the island of Coati, however, have features in common with the ruins of Tiabuanaco, and probably belong to the same epoch, and are to be ascribed to the same unknown and mysterious people who preceded the Peruviens, as the Tulluataecs or Toltecs did the Aztecs. Not far distant from the ancient site stands the present town of the same name, largely built from stones taken from the old ruins. Consult Stübel and Uhle, 'Die Ruinenstätte von Tiabuanaco' (Breslau 1892).

TIARA, the crown of the Pope, a cylindrical diadem with three crowns and a pointed top surmounted by a mound and a cross of gold, which the Pope wears as a symbol of sovereignit. It is placed upon the Pope's head at his coronation by the second cardinal deacon, with the words, "Receive the tiara adorned with three crowns, and know that thou art Father of princes and kings, Ruler of the world and Vicar of our Saviour, Jesus Christ." The tiara is not worn upon purely spiritual occasions, the Pope then wearing the mitre of a bishop. The first crown is said to have been added to the mitre by Nicholas I (858-867) as a symbol of unifying the prince of Christ with it; the second crown was added by Boniface VIII (1294-1303); and the third, first appears on the monument of Benedict XII (1334-42).

TIBALDI, té-bál’dé, Pellegrino, Italian painter and architect; b. Bologna, 1527; d. Milan, 1598. In 1547 he commenced his profound study of Michelangelo at Rome and painted for Cardinal Foggia, in his palace at Bologna, the 'History of Ulysses.' When Caracci saw these pictures, in which the style of Michelangelo appeared in a softened and refined form he pronounced Tibaldi il Michelangelo Riformato—an improved version of Michelangelo. He also decorated the chapel of Saint James for the Augustinians. Among his architectural works are the palace of Cardinal Borromeo at Pavia (1562); the Church of Saint Pidelis at Milan, and the new façade of the cathedral in that city. He likewise furnished Philip II who had summoned him to Spain in 1586, with the plan for the Escorial, and painted the ceiling of the library in that palace. Consult Gurli, 'Der Barockstil in Italien' (Stuttgart 1887); Zanotti, 'La pitture di Pellegrino Tibaldi' (Venice 1756).

TIBER, tî'ber (Italian, Tevere), Italy, a river rising in the Appennines of Tuscany, in central Italy, about 11 miles north of Pieve San Stefano, some 4,000 feet above sea-level. It is one of the largest and most celebrated rivers of the country, has a winding course, flows 244 miles and empties into the Mediterranean, passing many noted cities on its way to the sea, which enters by two branches—the Fiumicino and Fiumara. It is navigable for small craft as far as the mouth of the Nera, a distance of about 90 miles, but for small steamers only as far as Rome where it attains a breadth of about 250 feet. Its principal tributaries are the Nera and Paglia, which also receive their own affluents. The upper course is precipitous and the torrential streams which supply its water are the cause of its frequent overflow and consequent inundations. The chief cities on its route are Perugia, Orvieto, Ostia and Rome. The swift current carries along a vast amount of sediment from which condition arose the name 'yellow Tiber,' fluvius.

TIBERIAS, ti-bè'ri-as, Sea of. See GALLE-LEE, Sea of.

TIBERIUS, ti-bè'ri-us (TIBERIUS CLAUDIUS NERO CESAR), Roman emperor, son of Tiberius Claudius Nero, and Livia Drusilla, who was afterward married to the Emperor Augustus: b. 16 Nov. 42 B.C.; d. Misenum, 31 March 37 A.D. Brought up in the imperial household, Tiberius had by his conquests in Germany and Gaul gained the confidence of Augustus, by whom he was made a Roman consul. In 11 A.D. he was compelled, in order to retain the favor of Augustus, to divorce his wife, Vipsania Agrippina, and to marry Julia, the emperor's daughter, and in 14 A.D., shortly before the death of the emperor, he was formally adopted as his heir. According to Tacitus, the reign of Tiberius, although marked by cruelty and infamy which could have been possible to only the most profligate and dissolute of men, was rendered less tyrannous than might have been expected, by the subsistence of justice in matters of taxation and at times by a certain respect for the privileges of the Senate, and the rights of the common people, a course to be commended in a period of absolute despotism. The atrocious disregard of human life and liberty wherever his own private interests were at stake could, however, scarcely have been equalled. It was in this reign that the crime of 'lesa majestas' was established. Consult Jerome, T. S., 'The Tetrarchy of Tiberius' (in Classical Philology, Vol. VII, Chicago 1912); Mommsen, 'The Roman Provinces from Augustus to Diocletian' (1886); Schiller, H., 'Geschichte der römischen Kaiserzeit' (Gotha 1883); Tawney, J. C., 'Tiberius the Tyrant' (New York 1902).

TIBERIUS CONSTANTINE (TIBERIUS II), emperor of Byzantium: b. Thrace; d. Byzantium, 582 A.D. He was brought up by the Emperor Justin II whom he succeeded on the throne of the Eastern Empire in 578. It was during his reign that the great influx of Huns and Slavs in the north and east, and that of the Lombards in the west, began seriously to threaten the Roman empire.

TIBET, ti'bèt or ti'bät, or THIBET, a country of central Asia, under Chinese suzerainty, lying between latitude 28° and 36° N., and between long. 79° and 103° E. It is bounded on the north by East (Chinese) Turkestan, on the east by China proper, on the south by British India, Bhutan and Nepal and on the west by the Indian state of Kashmir. The area is estimated at about 465,200 square miles. Tibet forms the most extensive and loftiest mountain region in the world. It is structurally a complex of folded mountains whose intervening valleys have been filled up with detritus, converting them into plains whose general level lies from 10,000 to 17,000 feet above the sea, while the mountains tower almost as high again above the level of the adjacent plain. It is traversed along the southwestern boundary and the Karakoram with its outliers, by a range of the plateau of the country. These ranges have numerous peaks between 20,000 and 29,000 feet in height. On the northern boundary run the Kuen-Lun Range, sending numerous spurs and offsets into the plateau. The eastern half of Tibet is traversed by a system of more or less parallel ranges with a southeast trend. The enclosed plains in western and northern Tibet form closed drainage basins, very poorly watered, and containing salt lakes. The eastern longitudinal valleys are drained by the headwaters of the Yang-tse-kiang. Hoang-ho and Salwa rivers and in the south, along the northern base of the Himalayas, run the Indus to the west and the Brahmaputra to the east. The climate is excessively dry, with great and sudden fluctuations in temperature, and severe cold and biting north winds in winter. The vegetation is scanty and characteristic of desert and alpine regions. There are green meadows only along the streams and in the eastern mountains are forests of birch, poplar and coniferous trees. Wild animals are very numerous along the watered regions and antelopes, yak oxen and wild asses are characteristic of the range.

The inhabitants, who number about 2,000,000, are of a semi-civilized Mongoloid race somewhat akin to the Burmese. In the north they are nomadic, but in the south they are settled in substantial houses of stone or sun-dried brick, and cultivate the soil along the river valleys. The industries are not important, but there is a considerable trade with China, and wool, furs, musk, gold, borax and salt are exported. The language of the people is similar to the Chinese, but has taken on polysyllabic characters. A considerable amount of literature, mainly religious, has been accumulated, and printing has been practised for centuries. The prevailing religion is Buddhism, of the form known as Lamaism. The priesthood is exceedingly numerous and the government is a theocracy. At its head is the Grand Lama or Dalai Lama, who resides at Lhasa (q.v.), the capital, and who claims to be the head of the Buddhist world. This priest government has enforced a strict exclusion of non-Buddhist foreigners, particularly from Tibet. A Chinese resident was permanently stationed at Lhasa. Russian diplomatic influence seems to have gained a foothold in Tibet when, in 1905, the British Indian government took the occasion of the non-compliance of the Tibetans with the terms of the treaties of 1890 and 1893, governing frontier trade relations, to send a military expedition across the boundary. The avowed purpose was to negotiate with the Tibetan government, but the latter declined to negotiate and the British column pushed on toward Lhasa. On 31 March 1904 at Gara where the Tibetans had built a wall across the highway to oppose the advance, 1,500 of their soldiers were flanked and effectively enclosed in a circle. An attempt to disperse them, and then strike them rearward without meeting by the Tibetan general with a Sikh by a pistol shot which was the signal for a general onslaught by the Tibetans. A terrible magazine rifle fire, and the bringing into action of a mountain battery resulted in the slaughter of their soldiers, the British subsequently occupying their country and the Karo-la, and at Gyantse jongs or caves where for a time they were besieged by their
sands of Tibetans. The expedition eventually reached Lhasa; after long negotiations, ended only by threat of force, without any result. Colonel Younghusband concluded a treaty which was afterward censured by the Indian government as in excess of his instruction. Protest from the Chinese government led to the Anglo-Chinese convention of 1906, whereby England and China recognized the independence of Tibet, and secured China, as Suzeiian power of Tibet, paid an indemnity of 2,500,000 rupees. The agreement entered into between the two countries at this time was further strengthened by the conclusion of trade regulations between India and Tibet (1908). At the time of the Chinese Revolution in 1911 the Tibetans expelled the Chinese garrison, and an expedition subsequently sent out from Szechuan and Yunnan was withdrawn on the Great Britain's disapproval. In 1912 the British government outlined its attitude toward the Tibetan question, in accordance with the provisions of the treaty of 1906, objecting to Chinese assertion of sovereignty on Tibet. A tripartite conference was opened at Simla in 1913, but was dissolved without reaching any satisfactory agreement. Since that time Great Britain has declined to reopen negotiations. Consult Coales, O., *Eastern Tibet* (in *Geographical Journal*, April 1919); Gerard, F., *Tibet: The Country and its Inhabitants* (tr. from French, London 1904); London, P., *Lhasa: The Tibetan Expedition, 1903-04* (2d ed, London 1906); Lansdell, H., *Chinese Central Asia* (2 vols, London 1893); Rijnhart, S. C., *With the Tibetans in Tent and Temple* (London 1901); Younghusband, F. E., *India and Tibet* (London 1910).

**TIBET DOG** or **TIBET MASTIFF**, a breed of dogs about the size of a Newfoundland dog, but with a head resembling that of the mastiff, and having the fleshy and pendent ears. The color is usually deep black, with a bright brown spot over each eye; the hair is long and the tail bushy and well curved. This variety is extremely savage, and has been known from classic times, when it was employed by the Romans, especially under the emperors, in the games of the circus.

**TIBIA.** See ANATOMY; OSTEOLOGY, HUMAN.

**TIBULLUS, Albius, Roman poet:** b. about 54; d. about 19 B.C. He belonged to the equestrian order, and was on intimate terms with Messala (q.v.), whom in 31 he accompanied in a campaign in Aquitanian Gaul. He set out with him thence to the East also, but was forced through ill-health to land and he left behind at Corecyra. Henceforth he lived on his estate, between Tibur and Franeaster. Horace was warmly attached to him and addresses to him one of his epistles, in which he credits his friend with the possession of a tender heart, beauty, wealth, good health and good taste in everything. There are eleven books of elegies under his name, but the third and a part of the fourth are spurious. These poems are among the most perfect of their kind which have come down to us from classical antiquity. The elegies are characterized by graceful simplicity and tender feeling, and are free from the insipid prolixity into which Ovid frequently falls. The chief editors are those of Bährnens (Leipzig 1878); and Hiller (ib. 1885); Lachmann (1829); Möllner (ib. 1885); Postgate (1896). There is a translation by Duff (New York 1872). Consult Duff, J. W., *A Literary History of Rome* (New York 1909); Sellar, W. Y., *Horace and the Elegiac Poets* (Oxford 1892); Teuffel, W. S., *Geschichte der klassischen Pomischen Literatur* (Vol. II, 3d ed, Munich 1911).

**TIBURON, té-bóo-rón,** Mexico, an island in the Gulf of California, situated in the upper part of the gulf, 230 miles from the mouth of the Colorado River, and separated from the coast of Sonora by a channel from two to five miles wide. It is 30 miles long and from 10 to 20 miles wide, and covered with grass and desert vegetation. It is inhabited by the Cenis or Seris Indians, who have been left almost wholly to themselves by the Mexican government, and still live in a primitive state of nature. They are warlike and feared by the neighboring tribes on the mainland; use poisoned arrows, and are said to practise cannibalism.

**TIC-DOULOUREUX, tíc-dool-oó-ré.** See FACIAL NEURALGIA; NEURALGIA.

**TICAO, tíc-ków,** Philippines, one of the islands of Masbate province, lying northeast of Masbate Island, and southwest of Sorsogon, Luzon, area 140 square miles; with dependent islands 149 square miles. It is long and narrow, extending 23 miles from northwest to southeast, and narrowing gradually from a width of eight miles in the north to the southern point Cape San Rafael; the surface is rugged with many small mountain groups, and single peaks; the highest elevation in the northwest is 1,525 feet. The west coast is steep and rugged; the east coast indented by several small bays. Hemp, rice, sugarcane, cotton and chocolate are raised in small quantities; and gold is obtained from the river sands. The more important occupations of the people are stock-raising, weaving, fishing and hunting. Pop. 10,183.

**TICHBORNE (tích-bórn) TRIAL,** a famous English lawsuit in which was contested the validity of the claim of one Thomas Castro that he was Roger Charles Tichborne, heir of the Tichborne estates. Roger Charles, the eldest son of Sir Alfred Joseph Tichborne, died at sea in 1854 and upon the death of the second son, in 1866, the youngest was acknowledged heir. But Lady Tichborne said that her eldest son was really dead, and so she advertised for him. Castro, a butcher from Wagga Wagga, Australia, also known as Arthur Orton, of Wapping, came forward and claimed to be Roger, the rightful heir. He was accepted by Lady Tichborne, who, however, died before his suit to recover the estate began. The trial lasted 103 days and was ended by Castro being non-suited, 6 March 1872. He was arrested and charged with perjury and a trial of 188 days followed, a verdict of guilty being found 28 Feb. 1874. Castro was sentenced to 14 years' imprisonment with hard labor. He was discharged on a ticket-of-leave in 1884, confessed his imposture in 1895, and died in poverty and oblivion in 1898. The second trial, which was the longest in the history of the English courts, cost £55,315. Consult ʻThe Tichborne Romanceʻ (Manchester 1871).
TICINO, tê-chê'no (German Tessin), Switzerland, a canton situated on the southern frontier of the republic, and bounded on the east, south and west by Italy. Area, 1,086 square miles. The Saint Gotthard group of the Lepontine Alps forms the northern and the Adige Alps the eastern boundary. Ramifications of these fill the canton, but are cut by the valley of the Ticino River. The latter drains practically the whole canton, and empties into Lake Maggiore, which extends some distance. The town situated on the basin of this lake thus belongs to the basin of the Po. The upper mountain regions are rocky, but the southern part of the canton is very fertile, producing grain, fruits and grapes. Large numbers of goats are raised in the mountains. The principal mining industries are granite and marble quarrying. Commerce and manufactures are unimportant, although there is a considerable tourist traffic over the Saint Gotthard Railroad, which traverses the canton. The capital is Bellinzona (q.v.). In 1803 the canton of Ticino was formed by the union of the cantons of Bellinzona and Lugano, formerly part of the Helvetic Republic, and it was received as a full member of the Swiss Confederation. Pop. 136,556. See SWITZERLAND.

TICINO (German and French, Tesson), river of Switzerland and northern Italy, rising on Mount Saint Gondard, and flowing in a general southeast direction, first as a rapid torrent through the canton of Ticino, then through Lake Maggiore, and finally as a clear, navigable stream on the boundary between Piedmont and Lombardy. After passing Pavia it joins the Po. Length, exclusive of Lake Maggiore, 188 miles.

TICKELL, Thomas, English poet: b. Bridgwater, Somerset, 1686; d. Bath, Somerset, 23 April 1740. He was educated at Queen's College, Oxford, a fellowship of which he held 1709-20. He was the friend of Addison, who introduced him both into the world of letters and public life, and on becoming in 1717 secretary of state made Tickell under-secretary. He held the office of secretary to the Lords Justices of Ireland from about 1724 till his death, and published the first book of the 'Tladi, about the time of the appearance of the first part of Pope's 'Homer.' Addison declared that Tickell's version was the best, while Pope professed to believe it the work of Addison himself and wrote in reply the famous satire on Atticus. But without doubt Tickell made his own translation, which Addison corrected. Tickell's longest poem is 'Kenmington Gardens' (1722); his most popular, the ballad of 'Colin and Lucy'; while his finest is the elegy to Addison prefixed to his edition of Addison's works (1721). Consult Johnson, Samuel, 'Lives of the Poets' (Oxford 1915).

TICKET-OF-LIFE, a written license granted by the English government, whereby a penal convict was given his liberty for good behavior before the expiration of his sentence. It existed in the period of the Hanoverian colonial system, it was not adopted until 1740, when the colonies refused to receive more convicts. Certain restrictions were imposed on the recipient, requiring that he report to the police at stated intervals until his term expired, that he should not make change of address without notifying the police, etc. The system was much abused and it was said that in 1856, 2,666 convicts were thus liberated. The number of crimes committed increased and the necessity for more stringent measures led to the adoption of the convict system, under which only those convicts, sentenced for terms of more than two years and whose marks for good behavior and industry showed that they were entitled to it, were granted the license. The effectiveness of such a system is greatly increased by the cooperation of many charitable organizations which use every possible means to re-establish the ex-convict and to enable him to lead an honest, industrious life.

TICKNOR, Francis Orrey, American physician and poet: b. Baldwin county, Ga., 1822; d. near Columbus, Ga., 1874. He studied medicine and engaged in practice near Columbus. His verse, particularly that concerning the Civil War, was highly popular throughout the South. Several of his poems are in Steeman's 'Anthology,' and all of his verses were collected and published with a biographical sketch by P. H. Hayne, 'Virginians of the Valley, and Other Poems' (1879).

TICKNOR, George, American historian: b. Boston, 1 Aug. 1791; d. there, 26 Jan. 1871. He was admitted to the bar in 1813, but never adopted the law as an active profession. He lived in Europe 1815-18 for the purpose of pursuing his studies, and on his return was appointed to the Smith professorship of modern languages and literature in Harvard. In 1825 he resigned his professorship, and for the next three years traveled in Europe. On his return he devoted himself to writing a 'History of Spanish Literature,' published in 1849, in three volumes, a corrected and enlarged appearance in 1853. Its value was at once recognized by scholars and it was translated into Spanish, French and German. He produced in 1863 a 'Memoir of Prescott,' the historian. He also wrote 'Outline of the Principal Events in the Life of General Lafayette,' 'Remarks on Changes lately Proposed or Adopted in Harvard University' (1825); 'Remarks on the Life and Writings of Daniel Webster' (1831); 'Lecture on the Best Methods of Teaching the Living Languages' (1832). Consult Hillard, George S., and Ticknor, Mrs. Anna and Ticknor, Anna Eliot, 'Life, Letters and Journals of George Ticknor' (2 vols., 1870), critical ed., by Ferris Greenlet (1909).

TICKS AND MITES, small arthropods usually considered to be an order (Acracida) of the class Arachnida (q.v.). They have the common features of the body the mouth parts located on the head and thorax more or less united to form a cephalothorax, but the latter is continuous with the abdomen, often without the slightest indication of the line of union, and the segmentation is except in a few respects indistinct or unsegmented. The mouth-parts usually consists of piercing and sucking proboscis composed of the chelicerae and pedipalpi, the latter being made up in part of a jointed, usually tactile palpus, while the chelicerae may be subform and su-
1 Follicle Mite or "Blackhead" (Demodex homonius)  
2 Cheese Mite (Tyroglyphus siren)  
3 Tick (Ixodes redusus)  
4 Scarlet Mite (Trombidiun holosericeum)  
9 A Beetle Mite (Gamasus coleopterorum) at the left shown enlarged; at the right, devouring a beetle  
5 Water Mite (Atax spinipes)  
6 Pigeon Tick (Argas reflexus)  
7 Itch Mite (Sarcoptes hominis)  
8 Tick (Ixodes ricinus)
or two-jointed and clawed or chelate. The mature forms or imagos have pairs of walking legs of from five to eight terminated by variously arranged claws, or sessile suckers or pads; but the legs are variably modified, reduced to mere tarsus or two pairs or disappear altogether in parasitic forms. Respiration is by means of simple or branched tracheae, by one or three pairs of stigmata, or by a pair opening at the base of the proboscis. In the absence of all the special respiratory organs, may be purely integumental. The alimentary canal is commonly a sac which may be forked or much divided. In most cases there is no blood-sucking system. The tracheae are separated, the ducts open on the base of the abdomen and fertilization is accomplished through them. A few are parthenogenetic and limphorous is frequent. They are oviviporous or viviparous. The females differ greatly from the imagos in appearance and habits and almost alive three pairs of legs. After a few days, they form nymphs or pupae, which may be very different, and after a short metamorphosis into the mature form.

Ticks and mites are found in all parts of the world under every variety of environment. They are parasitic either temporarily or permanently, and on both animals and plants, and may be found in nests, etc., nests, lice, and under the bark of trees, many are either in fresh water or the sea, and some marine forms descend to great depths. While most of the members of this are direct relation to human affairs, affect our interests in important and 1 ways. Some, like the itch-mites, are of stinging diseases of man and animals like the cattle ticks and are the bearers of parasites, some are sericultural to our crops or to manufactured products, etc.; and many are benefactors of harmful insects and their life to their great powers of reproduction and their tenacity of life, the harmful are difficult to combat, preparations of lime or powerful insecticides are used against the colonies being the most effective. The number of known species amounts to thousands, although their mites have been little studied out of Europe. They vary in size from the pic mites to the large cattle ticks in length. Differing greatly not only in appearance but also in structure, rida are divided by systematists into families and subfamilies, of which representatives may be mentioned. Tribidae is an extensive family of 20 and 200 to 300 species of free-living with hard skins and robust bodies and three pairs of stalked stigmata and tracheae. They are mostly vegetable never parasitic and with the exception of a few aquatic forms lives in damp earth under leaves, bark, etc.

The Gamasidae are somewhat similar, with rounded bodies and a hard skin, but have only a single pair of stigmata at the base of the second pair of legs. The blood system is well developed. They often swarm on the underside of rove-beetles, carrion-beetles and other insects and some are parasitic on bats and birds; 35 genera and perhaps 200 species are already known.

The Ixodidae are the ticks, large blood-sucking species, with ovoid bodies and leathery skin capable of great extension. They are temporary parasites of vertebrates, chiefly of birds and mammals. As a rule the eggs are deposited in the ground; the newly hatched larva have three pairs of long clawed legs with which they attach themselves to a host, insert the beak and suck the fluids. When ready to slough they may drop off, seek concealment until the skin is changed, when the same maneuver is repeated. After passing through nymphal stage, the imagos live among herbage and shrubbery and upon opportunity again attach themselves, but usually in pairs, to some warm-blooded host, inserting the strong beak and drawing blood while reproduction takes place. The fertilized female becomes greatly distended, often to a spherical form, drops off and deposits her eggs, often to the number of 20,000 to 30,000. The large cattle-tick (Boophilus bovis) of the western ranges, now known to be the intermediate host of the parasite of Texas fever and a great scourge to cattle and other animals, is an example. Others are the wood-tick (Ixodes undecimtata), so common in New England, and certain European species, one a parasite of poultry and introduced into the United States, as the related dove-tick also has been.

The Hydrachnidae are the attractive and familiar water-mites, another large group of 40 genera and about 500 species. The adults, remarkable for their sexual dimorphism and brilliant colors, suck the juices of small crustaceans while the young are parasitic on aquatic insects and mussels. The brilliant scarlet eggs of some species are frequently found attached to aquatic plants and stones in a mass of jelly. A related family containing mostly marine predators is the Halacaridae. An allied family is the Trombidiidae, including the scarlet mites and the red spiders so well known to horticulturists. A very common one is Tetranychus telarius, which spins a web on the under side of leaves and is very destructive to plants during hot dry weather. Others cause great damage to orange and lemon groves. The young are parasitic on insects.

The disgusting itch-mites form a family (Sarcoptidae) of short, rounded forms which lack eyes, tracheae and stigmata altogether. They are microscopic and burrow in the skin of various animals, causing the diseases known as itch and mange, which are very difficult to eradicate but usually yield to persistent applications of sulphur washes. No less than 60 genera and 550 species parasitic on mammals, birds and insects have been described. (See itch.) Sheep-scarb and mange in various domestic animals are caused by related mites of the genera Psoroptic and Symbiotes. They all
TICONDEROGA — TICUNA

have the feet wonderfully provided with adhesive organs in the form of hooks, bristles and sucking cups. Closely allied are the Typhlophidae, comprising perhaps 30 species of minute forms with biting jaws. They are chiefly terrestrial, and the females lay their eggs in the female reproductive capacity and the enormous numbers in which they occur in slowly decomposing vegetable substances, etc. Here belong the cheese-mites (Typhlopsus soro and T. longipilus) which are cultivated and sold in certain cheeses in order to give them an appearance of maturity and an acid flavor. Many similar species infest stored grain, dried fruits, etc., and some, like Aleurodiscus and Rhyzoglyphus, destroy living roots, bulbs and grains. Another one abounds in unrefined sugars.

Two strictly parasitic families in which the body has become elongated and worm-like and otherwise degenerate are Demodice and Ero Ephidae. The former live in the hair follicles and sebaceous glands of man and domesticated animals. *Demodex follicularum* sometimes causes the *blackheads* which appear about the human nose; similar species infest the pig, dog, sheep, ox and other animals. That of the ox sometimes perforates the skin, and it has little value for food, because the body forms the legs are very small and degenerated and one pair may be lost. The second family is that of the galls which have but two pairs of legs, the posterior being sometimes represented by bristles. They form galls and the buds and leaves of plants whose juices they suck. Most of the species are confined to a particular species of plant, so that the 255 which have been described are probably but a small representation of those actually in existence. Some are parasitic in the galls made by others, recalling the inquilines among the gall flies.

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**TICONDEROGA,** ti-kon-de-ro'ga, N. Y., village, Essex County, on the stream which is the outlet of Lake George, and on the Delaware and Hudson and the Hudson Valley railroad, about 95 miles north by east of Albany, and a short distance from Lake Champlain and George. In the vicinity are rich deposits of crystalline granite, the chief source of the supply in the United States. The granite has been worked for over 100 years. The good water power is utilized for some extent for manufacturing. The chief manufactures are lumber products, wood pulp, paper and slate products.

Ticonderoga and vicinity become the early settlement of Vermont and is now New York. In 1755 a fort was built here by the French. This called it Fort Carli-

on, account on the Caroling or churning of the waters. The value of the site, near the head of Lake Champlain and at the entrance to Lake George, which, with a short portage, formed a water route to the Hudson, was recognized by both the French and English. Two years after the erection of Fort Carillon it was garrisoned by a force of 9,000 men under Montcalm. Wishing to extend the power secured by so advantageous a position, Montcalm attacked and captured Fort William Henry on Lake George. In July the following year General Abercrombie attempted to capture Fort Carillon, and although he had a force of 15,000, he was unsuccessful; his loss was about 2,300. In 1759 another and successful effort was made to wrest the fort from the French; General Amherst with a force of 12,000 captured both Carillon and Crown Point. After the beginning of the Revolutionary War, the whole region bordering on Lake Champlain, Lake George and the Hudson river became a battle ground. On 10 May 1775, a small force of Americans, less than 100 in number and known as "Green Mountain Boys," under Ethan Allen (q.v.), demanded the British commander surrender in the name of the Green Mountain and the Continental Congress; and thus, despite the fact that Allen held no commission and also that the Continental Congress had not yet convened, captured the fort, then called Ticonderoga. Burgoyne's plan of campaign included regaining this fort, and on 30 June 1777 he endeavored to capture the Americans, but failed. On 5 July of the same year, he made another attempt and this time succeeded. Later other engagements took place here and in the vicinity, but the English kept possession until after the surrender of Burgoyne. In 1780 as English force occupied the fort for a short time. At the close of the wars with England the fort ceased to be of importance, and as it was not occupied it soon became a ruin. Near the village stands a part of the gray stone walls of the old fort. Many tourists visit the village each year, and it has some note as a summer resort. Pop. 2,918.

**TICODUNOLOUS.**

**TICPOLONGA,** the name in Ceylon of Russell's viper (Daboa russelli) common in the south of India, Ceylon and Burma. See Russell's Viper.

**TICS,** spasmodic contractions of muscles, especially those which occur in the muscles of the face. Such affections are characterized by painful muscular twitching. The term is, referring to facial spasm, is especially applied to tic-douloureux. See FACIAL NEURALGIA.

**TICUNA,** te-koo'nà, or TUCUNA, te-koo'nà, a tribe of aboriginal Indians found in the forests of Brazil and Peru, around the confluence of the Parana and the Amazon. They are of slender but good physique, have dark skins, and live in a state of nature, their sole adornments being feather armlets and monkey teeth necklets. They live by fishing and hunting, and are respected for their honesty and straightforward dealings. Their birth, death and other ceremonies and customs are interesting. Early in the 18th cen-

DE-MILL, a water-mill so constructed utilize the action of the tide. This is accomplished by one of two methods. 1st consists of shutting off the water in a sill at flood tide, its escape through a giving the motion to the mill. In such a mill the return of the tide through the may also be utilized. The other and less method involves the placing of a horizontal wheel in the water to be turned by the current either in ebb or flow. The motion mill is not uniform; it attains its greatest velocity at half tide and is suspended en the turn of the tide; but with exception its suspension a uniform velocity can act through the use of a regulating wheel. The old London tide-mills, in use river Thames, were built on a platform that was entirely above the water-wheel, the millworks having never attained success owing to the inconvenience of gular a motive power. But in recently constructed mills an attempt is made to observe carefully by the use of an ingeniously contrived device.

DEMAND, Adolph, Norwegian painter: ndal, 1814; d. Christiania, 1876. He at Copenhagen and at Düsseldorf under nw, afterward going to Munich and Among his works are the large historical compositions 'Gustavus Vasa: Addressing the Statesmen' and 'Devotional Meeting of the clergy'; and many genre subjects, such cycle of 10 pictures illustrating 'Norwegian Peasant Life'; 'Grandmother's Bridal Day', and 'The Wolf Hunter's Tale.' He r many years painter to the king.

DES. 1. Introductory.—Persons living near the sea, especially in regions familiar with the semi-ising and falling of the waters, which th generally amounting to only a few ight suffices to cover and bare by turns the greatest part of the sea-shore. Without tide or any knowledge of the moon's posi- or any knowledge of the moon's posi- approximate time of the tide can be deduced from the observed time of occurrence of the same day, by allowing 30 minutes for its retardation. Toward and after the time of high tide, the Romans were well acquainted with the phenomena of the ocean tides as the writings of Caesar, Sen- lini, Dürer, Claudianus, and others show. By referring to the tides on the continent, and by turning to the sea-shore, the sea-tide as well as the river-tide and the ocean-tide, the phenomena of the ocean tides have been made by Laplace, Kelvin, G. H. Darwin, H. Poincaré, and others.

Definitions, etc.—The tide is the periodic and falling of oceanic and other large body of water, due mainly to the attraction of the sun and the moon as the earth rotates upon its axis. The tides have a remarkable stage at a particular time, and the waters, whether rivers, seas, or other causes which probably have no law of recurrence, although popularly called "tidal waves," cannot be regarded as a tidal phenomena. The rising and is accompanied by, and depends upon, lateral or horizontal movements of the waters called tidal currents or tidal streams or the flow as ebb. Their periodic character distinguishes them from ordinary ocean currents. The tide rises until it reaches a maximum height called high water and then falls until it reaches a minimum height called low water. The difference in height between a high and a low water is called a range of tide. At most ports two high waters and two low waters occur each lunar day. The average length of a lunar day is 24 hours 50 minutes 28 seconds. The interval of time between the transit of the moon across the meridian and the occurrence of high or low water is called a lunisolar interval. The average value of the high-water lunisolar interval at any seaport is sometimes called the corrected establishment to distinguish it from the high-water lunisolar interval on the days of new and full moon, which is known as the estabishment, or the vulgar establishment, of the port.

At the times of new and full moon the tidal and sun act in the same direction, whereas at first and last quarters they oppose each other. When they unite their forces we have spring tides, characterized by large ranges of the tide; when they are opposed, neap tides, having small ranges. The spring and neap tides usually occur soon after the corresponding phases of the moon. The interval is called the retard or age of the tide, or the phase of the phase inequality, and is usually less than 60 hours. The lunisolar intervals have their mean values at the times of spring and neap tides; the tides occur a fraction of an hour earlier between spring and neap tides, and later between neap and springs. Other things being equal, the range of tide is greater than usual by about one-sixth part when the moon is near perigee and about as much less than usual when near apogee. An increase or decrease of about one-tenth part of the range occurs when the moon is near the equator or near its point of extreme declination, respectively.

Diurnal inequalities among the tides of a day are due to the presence of a diurnal wave or partial tide, whose period is approximately 24 hours. The cause of this wave lies in the fact that if the moon is north or south of the equator, its tidal forces are stronger both in magnitude and in direction when two times half a lunar day apart are compared.

3. The Tidal Forces.—All particles of the earth (the seas included) will continue to occupy positions fixed relatively to one another if no other forces are impressed upon them than the following: the earth's attraction; its centrifugal force of axial rotation; and a force acting upon all of its particles alike, for example, the centrifugal force due to the revolution of the earth about the centre of gravity of earth and moon. If an extraneous force does not act upon all particles alike, then motions will be set up in the yielding parts. The attraction of the moon upon a given particle (near the surface, say) is along a straight line (at any given instant) from the particle to the moon's centre; its intensity, which is inversely proportional to the square of the distance, and its local direction (that is, direction with respect to the earth's surface) continually change.
as the earth rotates upon its axis. The attraction of the moon upon a particle at the earth’s centre (or upon the earth as a whole) is along a line drawn from the earth’s centre to that of the moon; it is independent of the earth’s axial rotation. Because the action of the moon on the surface particle differs from its action upon the particle at the earth’s centre there results a tendency to produce motion relatively to the earth’s centre. A consideration of this tendency will enable us to answer the question why there should be two high waters each lunar day, instead of only one high water. In a single sentence, the reason is that the moon attracts the waters on the hemisphere facing the moon more powerfully than it does the earth; but attracts the earth in general more powerfully than it does the waters on the farther side of the earth. The difference between the action of the moon at any point of the ocean and its action on the centre of the earth is the tide-producing force at the specified point. It is not difficult to show that, to higher powers of the small quantity $a/r$, the vertical and horizontal components of the moon’s tide-producing force are very nearly

$$\frac{M a^3}{E} g (3 \cos^2 \theta - 1)$$

and

$$\frac{M a^3}{E r^2} g \sin 2\theta$$

respectively, where $M$ denotes the mass of the moon, $E$ that of the earth, $g$ the force of gravity, $a$ the mean radius of the earth, $r$ the distance between centres of earth and moon, and $\theta$ the zenith distance of the moon corrected for parallax. The numerical value of $\frac{M a^3}{E r^2}$, when $r$ has its mean value, is 0.000000056; and so the vertical force has a range of 0.000000188g, as has also the horizontal force. The solar tidal force is 46 per cent that of the lunar. The tides are mainly due to the horizontal component of the forces. These are the forces which deflect a plumb line, although by an amount so small that it can hardly be measured. The deviation, in case of the moon, amounts to only 0.0017 either way from the mean vertical. For a sufficiently deep body of water extending 163 nautical miles along the equator the range of tide at either end will be one inch.

The system of arrows in Figs. 1, 2, 3 are intended to represent the horizontal component of the moon’s tide-producing force at various places on the earth’s surface. The arrows catted upon the same small circle are to be of equal length, and all arrows posed to lie in a system of great circles met in a point directly under the moon, of course, in the antipodal point. At points and along a great circle midway them the length of the arrows is zero: in words, the force vanishes. The syst

![Fig. 2.](image)

rows is fixed with respect to the so sweeps over the surface of the moon performs her apparent daily tour. The system shifts somewhat when north or south of the equator. At any point on the earth’s surface, the moon 1 the equator, the horizontal forces are

![Fig. 1.](image)

![Fig. 3.](image)

magnitude and direction to the horizon at $P$, a point upon the same parallel as $P$, but 180° distant in longitude; amounts to the same thing, they move themselves at any given point $P$ every day, or 12h, 25m. 14s. on an average. The moon is not upon the equator, are generally not the same at $P$ and $P'$ in magnitude or in direction, and so do exactly repeat themselves every half 1. This alternation of the forces gives diurnal inequality in the tides. It tend that for places situated upon the equator, the forces have, when is upon the equator, a meridional directed from the poles toward the e
his component nowhere points from the 
\( r \) toward the poles; consequently the ex-
\( \epsilon \); of the moon causes the water (half-tide) 
at the equator to be higher than it would 
\( \epsilon \) have been. The moon's movement in 
\( \epsilon \) ation, therefore, causes a fortnightly fluctu-
\( \epsilon \) a in half-tide level. Similarly the sun 
\( \epsilon \) es a semi-annual fluctuation.

**Real Equilibrium Tides.**—If in the case 
\( \epsilon \) body of water, its free period be several 
\( \epsilon \) smaller than the period of the tidal 
\( \epsilon \), say less than three or four hours, the 
\( \epsilon \) will at every instant be normal to the 
\( \epsilon \) line as disturbed by these forces. In 
\( \epsilon \) ar, consider the mean lunar semi-diurnal 
\( \epsilon \) a deep lake situated in north latitude. 
\( \epsilon \) ce to Fig. 1. It may be inferred that 
\( \epsilon \) water will occur at a point south of 
\( \epsilon \) the e point when the moon is on meridian; at 
\( \epsilon \) it west of the no-tide point at 3 o'clock; 
\( \epsilon \) time; at a point north of it, at 9 o'clock; 
\( \epsilon \) with easters must be treated as aggre-
\( \epsilon \)

\[ \sigma \frac{d \epsilon}{d \epsilon} (3 \cos^2 \theta - 1) \]

\( \sigma \), the density of the water and 
\( \epsilon \) the earth. The numerical value of 
\( \epsilon \) is 1.17 feet. The corresponding value for 
\( \epsilon \) is 0.54 foot. If the \( \sigma \frac{d \epsilon}{d \epsilon} = 0 \), the range 
\( \epsilon \) of the lunar tide becomes 1.8 feet; 
\( \epsilon \) = 1, 1, the range becomes 4.4 feet. In case 
\( \epsilon \) the earth \( \sigma \frac{d \epsilon}{d \epsilon} = 1 \), \( \epsilon \)

\[ \sigma \frac{d \epsilon}{d \epsilon} \]

\( \epsilon \) the hypothetical tide just described can be 
\( \epsilon \) calculated for any time and place and is 
\( \epsilon \) as the uncorrected equilibrium tide. It 
\( \epsilon \) no resemblance to the actual tide of our 

**Some Dynamical Questions Involved in 
\( \epsilon \) subject.**—Because the requirements for 
\( \epsilon \) tides are seldom found in the 
\( \epsilon \) of heavy aggregations of 
\( \epsilon \) of heavy particles undergoing some kind 
\( \epsilon \) illatory motion. A progressive free wave 
\( \epsilon \) has as its velocity of propagation 
\( \epsilon \) for the maximum velocity of the 

\[ \sqrt{\frac{h}{g}} \]

\( \epsilon \) h denotes the 
\( \epsilon \) of the vertical movement. The longest 
\( \epsilon \) 10 days period of free oscillation of a 
\( \epsilon \) area or sheet of water is 

\[ \frac{2 \lambda h}{g} \]

\( \epsilon \) sheets tapered or sharpened at the ends oscil-
\( \epsilon \) late more rapidly than do rectangular ones of 
\( \epsilon \) same length, while sheets narrowed at the 
\( \epsilon \) riddle or broadened at the ends oscillate less 
\( \epsilon \) rapidly. The free oscillations of a given body 
\( \epsilon \) water can often be approximately deter-
\( \epsilon \) mined by comparing with a more simple body 
\( \epsilon \) whose motion is known. The given body need 
\( \epsilon \) not have a strictly uniform depth nor be com-
\( \epsilon \) pletely surrounded by land.

The general equation of motion for matter 
\( \epsilon \) a rotating sphere show that a moving 
\( \epsilon \) of unit mass is deflected or accelerated 
\( \epsilon \) relatively to the earth's surface, toward the 
\( \epsilon \) right in north latitude, toward the left in south 
\( \epsilon \) titude, as if by a force whose numerical value 
\( \epsilon \) velocity \( \times 0.0001458 \) sin (latitude), the veloc-
\( \epsilon \) being expressed in feet per second and the 
\( \epsilon \)ce in pounds (Ferrel's law). This divided by 
\( \epsilon \) or 32.1722 gives the transverse slope which a 
\( \epsilon \) river, or strait through which there is a cur-
\( \epsilon \)ent, will assume on account of the deflecting 
\( \epsilon \) of the earth's rotation.

**7. Hypothetical Dynamical Tides.**—The 
\( \epsilon \) case of an equatorial canal encircling the earth 
\( \epsilon \) simple and instructive, although bearing no 
\( \epsilon \) resemblance to any existing tidal body. If the 
\( \epsilon \) of the water be greater than 67400 feet, 
\( \epsilon \) high water will occur when the moon is on 
\( \epsilon \) meridian (above or below the horizon); if less 
\( \epsilon \) 67,000 feet, low water will occur when the 
\( \epsilon \) moon is on meridian. For the depth 67,000 feet 
\( \epsilon \) range of tide will become very large. If 
\( \epsilon \) depth be greatly increased, the range will 
\( \epsilon \) approach its equilibrium value, which is 1.8 feet 
\( \epsilon \) for the lunar tide; if this depth be greatly 
\( \epsilon \) diminished, the range will approach the value 
\( \epsilon \) 0.000,026 h, h denoting the depth. In the 
\( \epsilon \) latter case the amplitude of the horizontal displace-
\( \epsilon \) ment will be 137 feet. For the depth of 10,000 
\( \epsilon \) feet the range of tide is 0.31 foot and the am-
\( \epsilon \) plitude of the horizontal displacement 161 feet; 
\( \epsilon \) for the depth of 20,000 feet the corresponding 
\( \epsilon \) quantities are 0.74 foot and 196 feet, respec-
\( \epsilon \) tively. If friction proportional to the velocity 
\( \epsilon \) be introduced, the effect will be to displace 
\( \epsilon \) the crests of the lunar and solar wave with refer-
\( \epsilon \) ence to the moon and sun, but by unequal 
\( \epsilon \) amounts. To this has been attributed the age 
\( \epsilon \) of the tide.

**8. Partial Explanation of Ocean Tides.**—
From §§ 3, 4 an idea of the magnitude of the 

**equilibrium tide can be obtained. It represents**
the direct effect of the action of the moon upon 
the waters where the body is so small and deep 
that its motion can be ignored. In a larger 
body whose free period is quite different from 
that of the tidal forces it is reasonable to sup-
pose that tides even smaller than the equilib-
rium tides will be raised. In § 7 this was found 
to be the case for an equatorial canal of mod-
erate depth encircling the earth. Again, if a 
canal, bounded at each end, be so shallow that a 
wave-length \( \lambda \) extends through only a few 
degrees of a great circle, then even if its 
length approximates to \( \lambda \) the tides are obviously 
small because the tidal forces are distributed 
alike on both halves, while the particles move 
in opposite directions in the two halves. Re-
sults like these contrasted with those obtained 
from observing the tides of the oceans lead to 
the belief that, as a rule, the ocean tides as we 
know them are so great that they can be pro-
duced only by successive actions of the tidal forces upon oscillating systems each having, as free period, approximately the period of the forces, and each perfect enough to preserve the general character of its motion during several such periods were the forces to cease their action.

That oscillations according to one of the free periods may persist for a long time can be seen in the case of some seiches; for, a probably started by a meteorological force and sustained by no periodic force, in some harbors, straits, or bays, an exceptionally large number of oscillations before the said systems are to be carried away progressive waves or otherwise.

Suppose the oceans by reason of their and the configuration of shore lines to several such systems whose free periods nearly the periods of the tidal forces. It systems generally consist of still more sheets having like periods and which styled "areas." The times of tide can be by means of the following rule:

If to the particles of water in a given oscillating system, each area of uniform and wherein the resistances are proportional to the velocities of the particles, a series of harmonic forces having for period period of the body of water be applied, as permanent state established, then must the elongation be simultaneous with the when the virtual work of the external forces upon the system becomes zero.

The forces in various parts of the earth at various times or hours are those of 4, projected upon the lines of motion of the tides. The virtual displacements are at each assumed hour, but differ in parts of the system.

9. Cotidal Lines.—Although the cotidal in the ocean are generally real and distinct, seldom indicate the progression of a wave the rate due to depth; such progressions, however, exist in many shallow arms of the particular in tidal rivers. Because the principal ocean tides are due chiefly to oscillations, as has just been pointed out, one may expect to find extensive regions in the Atlantic Ocean extending from the eastern Greenland line to the Gulf of Mexico, the east coast of Central America, the western coast of the Philippines, the east coast of Africa, the northern coasts of Morocco and Portugal, and like these the rise and fall amounts to feet even off shore and in deep water.

The Arctic Ocean is characterized by progressive tides of small range derived from tidal forces. In the oceans, in certain arms of and in certain lakes are to be considered number of no-tide points due to various causes. From a point of this kind all cotidal lines belonging to a tidal and so these lines, or the tide which they show, are there said to be "amplitude of the tide." Excluding lakes and seas not common tidally with the ocean, and considerin
TIDES

semi-daily tides, about 25 no-tide points can be enumerated; a large percentage of these are to be found in straits and sounds.

A lake whose longest free period of oscillation is the same as that of the tidal forces will experience equilibrium tides and possess a no-tide point situated at the centre of gravity of the surface of the lake. The sequence of the cotidal lines about the point will be the same as that of the tidal forces. (Fig. 4.) For semi-daily tides the numbers will increase in the clockwise or counter-clockwise sense according as the point lies in north or south latitude.

In a strait or sound a nodal line is reduced to a no-tide point through the deflecting force described in § 6; around such a point the sequence of the tide is the reverse of that of the forces. If a no-tide point is due to the overlapping of two systems, the sequence depends upon the other tidal systems.

10. Peculiarities of Tides.—The distance between the Antarctic Continent and Australia being more nearly equal to the half length of a solar wave than of a lunar, causes the solar wave to appear comparatively large along the southern coast of Australia. The same is true, but in a lesser degree, for the region between the Antarctic Continent and South Africa. The distance from the Antarctic Continent to the Atlantic Coast of the United States being a little more than one and one-half lunar wave-lengths causes the ratio of the solar to the lunar wave to be comparatively small along this coast. If the ocean oscillate differently for different constituents, we can readily see reasons for considerable differences of epoch and so for remarkable instances of the tides.

If a tidal river be so shallow that the range of tide is a considerable fraction of the depth, ordinary wave-like oscillations of the water are no longer possible. The result is that as the wave progresses, the duration of the rise will be shortened and that of the fall lengthened. An extreme case results in a phenomenon called a bore — an advancing wall of water, which may be several feet in height, flowing up the bed of a river. A bore (see below) occurs in the Peruvian River, an affluent of the Bay of Fundy, its height at Moncton being three or four feet. Bores occur in several of the rivers of India, in several of western Europe, in the Amazon River, in the Tsien-tang Kiang and in Turnagain Arm, Alaska. Various other peculiarities in the shape of the wave are due to the shallowness of the water. A much contracted entrance to a bay not only reduces the range within, but alters the shape of the wave.

On the other hand, the range may increase as the tide passes up a funnel-shaped bay or estuary, and especially may this be the case when the bay has a large stationary oscillation related to the waters outside. The Bay of Fundy has at its head a spring range of nearly 50 feet, which fact depends upon both of these circumstances. But the large tides in Bristol Channel, England, and in Bristol Bay, Alaska, are due chiefly to the contracting and shoaling of these bodies.

A rule of thumb is that strong tidal currents occur in straits, tidal rivers, over shoals, and off capes.

Along the open coast and in the ocean at large, tidal currents generally set successively in all directions, the motion being elliptically harmonic or nearly so. This horizontal motion having two degrees of freedom is much harder to specify than is the tide, or motion defined by the rise and fall of the surface. Points at which the velocity ellipses or hodographs become circles may be styled circular points.

11. Tides in the Earth's Crust.—By these are meant the rise and fall experienced by the surface of the apparently solid earth due primarily to the tide-producing forces of the moon and sun acting upon the earth's crust and all matter within.

With the exception of § 5, we have made no mention of the attraction of the tidal forces upon themselves because the density of water is only 2/11 that of the solid earth, and the depth of the ocean is but a small fraction of the earth's radius. In the production of body tides not only is the direct disturbing action of the tidal forces involved, but also the attraction of the matter, however, disturbed upon itself.

Let \( \sigma \) and \( \sigma_e \) denote the rise and fall of the ocean's surface as measured from the earth's centre and expressed in terms of the earth's radius, \( \sigma_e \) being the rise and fall of the surface of the solid earth similarly measured; then the actually observed rise and fall of the waters surface relatively to the land is \( \sigma = \sigma_e - \sigma = m \).

The value of \( \sigma_e \) is required. From theoretical considerations of the direct and indirect effect of the tidal forces,

\[
\sigma_e = k_a \sigma_a = \frac{k_a}{1 - k_b \sigma_a} = \frac{k_a}{1 - k_b}
\]

where \( \sigma \) denotes the range of the equilibrium tide in an ocean of small density covering the earth, due to the direct action of the tidal forces; \( k_a \) and \( k_b \) are two moduli depending respectively upon the elasticity and internal constitution of the earth; \( k_a \sigma_a \) denotes the range of the deformation in the surface of the solid earth due to the direct action of the tidal forces.

Assuming that the day has not altered in length since the earth was in a fluid state, or when \( k_e = 1 \), we have observed ellipticity of the meridian due to diurnal rotation.

\[
\frac{1}{1 - k_e} = \frac{1}{1 - k_e} = \frac{297}{578} = 0.486
\]

whence \( k_e = 0.486 \).

The value of \( k_e \) can be determined by comparing the observed period of the movement of the axis of figure about the axis of rotation with the period of free precession (or 305 sidereal days) obtained upon the assumption of a rigid earth.

Another determination of \( k_e \) is obtained by comparing the observed range of the monthly or fortnightly tide with the equilibrium range due to the direct action of the tidal forces. This ratio or \( m/a \) is found to be about 3/5. Daily or semi-daily tides in a deep lake or in a buried pipe also give a determination of \( m/a \). The actual deviation of the vertical from its mean position, due to the daily or semi-daily tidal forces, and obtained by means of a horizontal pendulum, gives, upon comparison with the direct theoretical deviation, another determination of the ratio \( m/a \). If \( k_e \) be taken as 0.5, and \( m \) as 0.3, then by the above equation,
that the actual rise and fall of the surface of the *solid* earth is about 3/8 of the rise and fall of the surface of an ocean of small density surrounding a rigid sphere. If the latter be 1.8 feet (§ 5), the former will be about 1.2 feet. [This mode of treatment is due to Ch. Lallemant.]

12. Observation of Tides.—The height of the surface, at any given time can be directly observed upon a graduated fixed staff if the water be tolerably smooth. A long box fixed in a vertical position, having a small opening near the lower end, and usually supplied with a float, enables one to observe during stormy weather as well. In some instances only the times and heights of the high and low waters are observed and recorded. But a more satisfactory record is obtained by reading the gauge at regular intervals one hour or one-half hour apart.

Automatic or self-registering gauges are usually constructed for drawing a continuous curve. Such a gauge consists of a float and box, a time-piece, and some form of recording apparatus. The record from an automatic gauge can be procured with comparatively little trouble; it shows clearly the peculiarities of the tide; and it furnishes material for a thorough analysis or discussion.

The velocities and directions of tidal streams are usually ascertained by aid of a float and line or some form of current-meter. Such observations are attended with considerable difficulty because they must generally be made at some distance off shore.

13. Analysis of Observations.—If only the high and low water are to be treated, they are first referred to the moon's transit for obtaining lunntidal intervals. The ranges of tide are found at the same time. The intervals and the heights or low-ranges are next classified according to certain astronomical arguments for the purpose of bringing out the corresponding tidal inequalities.

The harmonic analysis rests upon Laplace's principle of forced oscillations, namely:

*The state of any system of bodies, in which the conditions of the motion have disappeared through the resistances which the motion encounters, is coteriodic with the forces acting on the system.*

Here is the clue to what oscillations ought to be found in the tidal wave; for, there ought to be an oscillation corresponding to each term of the causes producing the tide. Such terms follow from the development of the tide producing potentials of the moon and sun. Their arguments and *speeds* involve simple combinations of the mean longitudes and mean motions of the local meridian projected on the celestial sphere, the moon, the sun, the equinox, the lunar perigee, the solar perigee, and the moon's node. There are three principal classes of terms: semi-diurnal, diurnal, and long-period. If for a sufficiently long time the observation curve be read and summed with reference to any constituent or component defined by its "speed," the effects of the other components will gradually disappear and the final sums will pertain to the one sought (including, of course, its harmonics). To avoid reading the curve with reference to each component, the tabulation according to mean solar time is made to serve for all. This is done by distributing the (solar) hourly heights among the component hours as nearly as possible. This also shows the proper distribution of hourly heights as well as blank forms into which the heights are to be copied have been used quite extensively. For about 30 years perforated sheets, known as stencils, have been used for pointing out which hourly heights of the tabulation go with the various hours of the component sought. These enable one to dispense with the labor involved in copying into the various forms. Some years ago a set of movable scales or strips was devised upon which the hourly heights are copied once for all summations. Several machines have been devised or constructed for facilitating the work of analysis, but they have not yet come into actual use.

Through the 24 partial sums or means finally obtained for a given component (and its harmonics) imagine a curve to be drawn. It may be represented by a Fourier series whose coefficients and initial phases can be taken with little difficulty. Then by taking the initial phases from the proper astronomical arguments for that time, the required epochs will be obtained.

14. Prediction of Tides.—At most ports the time of tide can be roughly predicted by adding the time to that of the moon's transit, upper or lower, the average value of the lunntidal interval or *establishment* for the port. When the diurnal wave is not large, the height of high water above mean sea-level is roughly equal to half of the mean range of tide; the low water is as much below this plane or datum.

Where great refinement is desired, the process just referred to involves much labor, and can best be carried out after a tolerably complete harmonic analysis has been made. This done we have only to add together a series of cosine terms for obtaining the height of the surface of the sea at any given time. But the number of these terms is so great that such a computation would soon become laborious, since it must be made for many assumed times in each day's predictions. Several predicting instruments have been designed or constructed. Generally speaking, the object of such an instrument or machine is to combine several harmonic motions of suitable periods, phase and amplitude and to combine the results into one compound wave, or perhaps into two compound waves. The simplest form may be described thus: Upon one or more shafts, driven by hand or by clockwork, are fixed a number of wheels which mesh into other wheels, causing the latter (or wheels moved by them) to revolve with angular velocities having given ratios to the angular velocities of the shafts. These ratios are taken as nearly as possible, proportional to the speeds of particular tidal components. Rigidly connected to these wheels are cranks carrying pulleys, or pins working in slots and which impart to vertical rods carrying pulleys rectilinear harmonic motions. At one end of the machine a chain or flexible wire is made fast; hence it is laid alternately over and under the pulleys. Near to the other end of the chain or wire is attached a marking point (time, which is attached to the line of motion of the paper roll, traces the tidal curve. It is evident that the machine continually sums a series of cosine terms.
TIDEWATER — TIECK

The instrument include a set of cranks at
angles to those giving the tide curve, to
with pulleys and a summation chain or
the movement of a point on the chain
the place of the tracing point) across a
or mark, corresponding to mean sea-
still show the time when a high or low
occurs.

original and simplest form of instru-
that due to Kelvin. The one designed
is somewhat complicated, inasmuch as
ates out the principal but the minor com-
ment, used in the office of the United
s the Geodetic Survey for about 30 years.

advantage consists in indicating upon
the times and heights of the tides. The
is recently completed and put in opera-
nachine which besides tracing a curve,
Kelvin's indicates upon its face the
heights of the tides,—the times be-
known through the additional mechan-
described.

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of Great Britain, France, Germany, the
States and other countries.

ROLLIN A. HARRIS,
Author of Manual of Tides.

TIDEWATER, arms of the sea, bays, and
waters where the tide ebbs and flows
lie, and all persons may use the same
purpose of navigation and fishing, un-
trained by law; in such waters the tide
ually ebb and flow. It is the rise and
water, and not the proportion of salt
fresh that determines whether or not
icular portion of a stream is within tide-
the same determination applies to small
as well as large ones. Open sea is the
of all nations; the rights and privileges
if any, being restricted to a specified
from the shore—generally three miles.
United States the titles to tidewaters and
vested in the States abutting thereon,
citizens, but are subject, however, to
stitutional rights of the United States.
gress of the United States, under its
ominate commerce, has the control of
able waters, and for such purposes
the property of the nation and to
islation; the test of navigability
whether or no the waters form a con-
highway over which commerce may be
on.

arious bathing beaches where the ocean
has become very valuable, private
parties and owners of bathing pavilions often
occupy the region between high and low water,
and shut out or try to shut the public there-
from. This they have no right to do. Neither
has any municipality a right to construct a
bridge over a tidewater stream so as to ob-
struct navigation, which is the public
right. The mariner also has the right to land
wherever the shore connects with a public
highway. Owners of land or a tidal shore have
right to build a pier or wharf for convenience
in landing and embarkation, but the mariner
passage along the tide line, and must not block
navigation. The right of fishing in tidal waters
cannot be stopped by any adjacent landowner,
though it is subject to local enactment for the
protection of fish. Oyster beds often lie in
tidal waters, and have been the subject of much
dispute. See Riparian Rights.

TIECK, Johann Ludwig, German drama-
ist and novelist of the Romantic School, known also under the pseudonyms, Peter Lebrecht and Gottlieb Faber; b. Berlin, 31
May 1773; d. Berlin, 28 April 1853. He was of
lowly origin, his father being a poor rope-maker.
From 1782 to 1792 he attended the Friedrichs-
werder Gymnasium in his native city, coming
under the influence of teachers with literary
inclinations (Rambach, A. F. Bernhardt), and
beginning a friendship with Wadem, father
that was to last until the latter's death.
His wish to become an actor was denied by his
parents, and he was obliged to go to the Uni-
versity of Halle (1792) to study theology and
philology, and to the University of Göttingen
(1792-95), where he took up modern philology
and literature. In 1797 he wrote cheap stories
for the apostle of enlightenment at Berlin, Nicoll
and, during a short stay in Hamburg, made
the acquaintance of Klostock and Schröder,
and became engaged to Miss Alberti (d. 1837),
whom he married the following year. He be-
came thoroughly well acquainted with all the
members of the early romantic school in Ger-
many, in 1788-1800, while living in the univer-
sity town of Jena (the two Schlegels, Novalis,
Fichte, Brentano, Gries), as well as with Goethe
and Schiller, who were living at Weimar,
short walk from Jena. For 15 years, begin-
ing 1802, Tieck and his wife lived, with few
interruptions, on the Ziehinger estate (near
Frankfort on the Oder) of his intimate friend,
Wilhelm von Burgsdorff (really the property
of the latter's uncle, Count Finkenstein). He
traveled in Italy (1804-06) with his sister Sofie
(1755-1833), who had married Bernhardt, and
in various libraries on this journey he became
acquainted with important manuscripts of
medieval German poems ('Nibelungenlied,' 'König
Rother,' etc.). In 1819 he settled in Dresden,
where he became (1825) manager of the Court
Theatre, with the title of Hofrat. The last
years of his life were spent chiefly at Berlin, to
which city he was called (1840) by King Fred-
reich William IV of Prussia, who greatly ad-
mired his work, and who granted him an annual
pension of 3,000 thalers. Together with Fre-
rich Schlegel (q.v.) and August Wilhelm
Schlegel (q.v.), Tieck was the founder of the
Romantic School in Germany, and while he was
not the most profound or original writer of this
movement, he certainly was its most versatile
member. His connection with C. A. Nicolai
TIED ISLANDS. See SHORE LINE.

TIEDEMANN, tie-de-man, (at) Gustavus, American legal writer: son, S., 16 July 1857; d. Buffalo, N. Y., 8 Aug. 1903. He fxqat in 1876 the College of Charleston and from the University of Missouri in 1879 and was professor of law for 10 years. Among his publications are "The Law of Property" (1883); "Limitations of Power" (1889); "The Unwritten Constitution of the United States" (1890); "State and Federal Control of Persons and Property" (1892). TIEFBEUG', Diedrich, German philosopher: b. Bremerode, 3 April 1878; d. Bamburg, 24 Sept. 1803. He was professor of philosophy in the University of Marburg, 1776 and published "Researches on the Or of Language," "System of the Spirit of Greek" (1777); "Origin of the Magic of Greece" (1780); "Spirit of Speculative Philosophy" (1790-97), his prime work; "Skeptikos; or, Human Knowledge" (1794).

TIEDE, tie'de, Christoph August, man poet: i. Gardelegen, Prussia, 14 1752; d. Dresden, Saxony, 8 March 1841. His work is distinguished as the author of the lyric-didactic poem (1800), and "Mirror of Women." He also wrote "Wanderings in Life's Market," and "Elcctri" have been many, and his poetry has been compared with that of Cuvier. Following his death the Tiege Foundation was established for the purpose of assisting and artists on their widows and children, also for the care of the poet's grave. C. Kern, "Beiträge zu einer Charakteristik Dichters Tiege" (Berlin 1896).

TIEFELAND. See MARTA OF THE LANDS.

TIEGHM, tie'gheem, Philippe-l Léon van, French botanist: b. Batteul, 14 1839; d. Paris, 30 April 1914. He was professor of botany at the Museum (1800) of the Institute National Agronomique (1840). He is known as one of the classificators of the vegetable kingdom and proposed a new classification of the vegetable world. He published the phanerogamia according to the plan of the table world. He established a new division in the Journal de Botanique and theAnnales des Sciences Naturelles.

TIELE, ti'l. Cornelis Petrus, writer on comparative religion: b. Leyden, Dec. 1830; d. there, 14 Jan. 1902. He lectured at Leyden and Amsterdam, and was pastor of the Remonstrant conger at Middelharnis, and in 1869 was ordained to the Reformed Church in the United States, and was named director of the Remonstrant theol. school.

TIECK, ti'k. William Hartmann.

TIEDEMANN, tie-de-mann, (at) Gustavus, American legal writer: son, S., 16 July 1857; d. Buffalo, N. Y., 8 Aug. 1903. He fxqat in 1876 the College of Charleston and from the University of Missouri six in New York University. From May 1883 he had been a professor of law at Columbia University. Among his publications are "The Law of Property" (1883); "Limitations of Power" (1889); "The Unwritten Constitution of the United States" (1890); "State and Federal Control of Persons and Property" (1892). TIEFBEUG', Diedrich, German philosopher: b. Bremerode, 3 April 1878; d. Bamburg, 24 Sept. 1803. He was professor of philology in the University of Marburg, 1776 and published "Researches on the Or of Language," "System of the Spirit of Greek" (1777); "Origin of the Magic of Greece" (1780); "Spirit of Speculative Philosophy" (1790-97), his prime work; "Skeptikos; or, Human Knowledge" (1794). TIEDE, tie'de, Christoph August, man poet: i. Gardelegen, Prussia, 14 1752; d. Dresden, Saxony, 8 March 1841. His work is distinguished as the author of the lyric-didactic poem (1800), and "Mirror of Women." He also wrote "Wanderings in Life's Market," and "Elcctri" have been many, and his poetry has been compared with that of Cuvier. Following his death the Tiege Foundation was established for the purpose of assisting and artists on their widows and children, also for the care of the poet's grave. C. Kern, "Beiträge zu einer Charakteristik Dichters Tiege" (Berlin 1896). TIEFELAND. See MARTA OF THE LANDS.

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TIEMANNITE—TIERRA DEL FUEGO 619
yden from 1873 till his death, and
1901 held the professorship of the
philosophy of religion in the Uni-
versity of Edinburgh, and in 1889 he delivered the Gifford
Lectures on the University of Edinburgh, pub-
lished as 'Elements of the Science of Religion' (1897). He was one of the pioneers
of comparative and historical re-
search on thought of the Orient, e.g., 'The
Zoroaster' (1864); 'Comparative the Egyptian and Semitic Religions' (3d ed., 1901); 'Western Asia in the
Most Recent Discovery' (1894); 'Comparative Religion' (1905).

NIITE, native mercurel selenide,
y, metallic mineral of high specific
to 8.5; and a hardness of 2.5. It
sive with chalcopyrite in the Harz
in Germany, and in choice iso-
heraldic crystals at Marysvale, Utah.

SIN, tē-ĕn-tso̞n', China, a city and
the capital of province of Chihli, situated
ho River, 70 miles by water from
in the Gulf of Pechili. The old
square surrounded by walls and
traversed by broad, straight streets.

To the south lies the European
part of the southeast of Peking, with
connected by rail and also
with urian Railroad. It is the
the capital, although large ves-
t ascends the river. Its position
the terminus of the Grand Im-
, however, makes it one of the
ad centres of the empire. The total
imports amounted (1916) to about
of which more than one-third
imported from foreign countries;
taled $34,097,085. Tientsin was be-
a detachment of Taiping rebels in
Taiping army was on the way to
the defeat at Tientsin saved the
attack. In June 1900, during the
the city was occupied, after
by the allied troops. Pop. es-
800,000. See CHINA.

LO, tē-ă pó lō, Giovanni Battista,
oletto). Italian painter: b. San
Castello, near Venice, 5 April 1696;
22 March 1770. He was a pupil
Lazzarini and followed as closely
in the footsteps of Paul Veronese;
reproduced in numerous wall
pictures. Many churches and pa-
cence were decorated by his hand.
he was summoned to Würzburg.
three years he worked in the arch-
dace on the wall paintings in fresco
'Four Quarters of the Earth,' and
Fréderick Barbarossa.' In 1754 he
to Vienna, where he was attached to
Art.
In 1763 King Charles III sum-
med to Spain to decorate the royal
ehere he painted 'Smithy of Vulcan,' is
Spain; and the ceiling frescoes
d her Provinces. He was the last
of the Venetian school. His
was superb, and his designs spiritual
issive even when the drawing was
incorrect. Among Tiepolo's easel pictures may
be named 'Christ in the Garden'; 'Adoration of
the Kings' (Imperial Gallery, Vienna); 'After the Bath' (Berlin Museum); 'Ennean-
uncate Conception' (Vicenza Museum, Vicenza); and 'The
-
Isabella' (1740). Many of his altar pieces are in the churches of
of Venice. A few of his paintings are in the
Metropolitan Museum, New York. Consult
Chenuviers, H. de, 'Les Tiepolo' (Paris 1888); Ghelof, Urbanide, 'Tiepolo in Spain' (Venice 1881); Molmenti, P. G., 'G. B. Tie-
polo' (Milan 1910); 'Masters in Art' (Vol.
VI, Boston 1907).

TIERNAN, Frances Fisher ('CHRISTIAN
Rein'), American novelist: b. Salisbury, N. C.,
5 July 1846. Among her many works are
'Valerie Aymar' (1870); 'Morton House'
(1871); 'Nina's Atonement' (1873); 'A
Daughter of Bohemia' (1873); 'A
Question of Honor' (1875); 'The Land of the Sky,' a
volume of travel (1875); 'Donny Kate' (1879); 'Hearts of Steel' (1882); 'Mervin Churichill' (1887); 'Philip's Restitution' (1888); 'Armine'
(1884); 'The Land of the Sun' (1894); 'The
Picture of Las Cruces' (1895); 'The Man
of the Family' (1896); 'Weighed in the Balance'
(1901); 'A Daughter of the Sierra' (1903); 'Princess Nadino' (1908); 'The Light of the
Vision' (1912); 'The Daughter of a Star'
(1913); 'A Far-Away Princess' (1914); 'The
Secret Bequest' (1915). In 1909 Mrs. Tiernan
was awarded the Larteg Medal by the
University of Notre Dame.

TIERRA DEL FUEGO, tē-ĕr-rā del fwa-
-gō, an archipelago at the extreme south
of South America, separated from the mainland
by the Strait of Magellan which forms its
boundary on the north and northwest, while
the Atlantic Ocean bounds it on the east and
the Pacific Ocean on the southwest; total area
about 19,299 square miles. Politically, it is
divided into two parts, each of which will be
briefly described.

(1) The western part, the area of which is 11,000 square miles, belongs
to Chile and is included in the extensive Chilean
territory of Magallanes, whose capital, the
little town of Punta Arenas, stands on the
western (mainland) shores of the strait, and
is a port of call for steamship lines between
Europe and Australian lines (Hamburg to Cal-
lo, etc.). The lands belong to the state.

(2) The eastern part, area 8,299 square miles and
population about 1,000 whites and several thou-
sand Indians, belongs to Argentina and forms
a territory of that republic, its capital being
Ushuaia. Of this region about 1,000,000 acres
have passed into private ownership and only a
small proportion is rented. In the north there
are fertile valleys and roads connecting the
villages lead through Chilean territory to ports
on the southern coast of the Strait of Magel-
lan. The interior is mountainous or hilly, but
well adapted to stock-raising. "The climate of this region," it is said, "though cold, is not
severe, inasmuch as the mean temperature,
maximum and minimum, as taken during sev-
ral years, is +5° C. and —10° C, respec-
tively. Calm days are frequent in winter.
Rain increases in the autumn, and in the
summer dry winds from the southwest and west
prevail, and occasionally are of terrific force." (Consult 'Argentina Republic: a Geographical
Sketch,' issued by the International Bureau of
TIERS-ETAT—TIFFANY

American Republics, Washington 1903). There are no navigable rivers, but many streams of moderate size and a number of lagoons. The oldest and in some respects still the most interesting description of the region of the famous strait (of which both shores are now held by Chile) is that written by Anthony Pigafetta, who accompanied Magellan and told of what they saw in October 1520, mentioning the characteristic storms, the very great and high mountains covered with snow, surrounding the strait, and finally saying: "In it we found at every half league a good port and place for anchoring, good waters, wood all of cedar and fish like sarines, missiglioni, and a very sweet herb named appio (celery). There is also some of the same kind which is bitter. This herb grows near the springs and from not finding anything else we ate of it for several days. I think that there is not in the world a more beautiful country or a better strait than this one." Pigafetta's sketch map of Magellan's Strait proves that he regarded Tierra del Fuego as a great southern continent stretching toward the antarctic pole. Consult Lord Stanley of Alderley, 'The First Voyage Round the World,' printed for the Hakluyt Society.

TIERS-ETAT, ti-är-zä-tä, the third estate, a name early given in France to the free bourgeoisie, to distinguish them from the nobility and the clergy, the other two estates. The three estates together formed the états-généraux or States-General, a legislative body which might be compared to the English Parliament. The third estate became famous in the political upheaval in France at the end of the 18th century, when, in the last States-General, it claimed power equal to that of both of the other orders. In 1789 it assumed the name of the National Assembly, and by its subsequent assumption of supreme power consummated the French Revolution. See France—History From Revolution to Empire.

TIJTJENS, ti-yens, or TITIENS, Therese Johanna Alexandra, German soprano singer of Hungarian descent; b. Hamburg, 17 July 1831; d. London, England, 3 Oct. 1877. She made her début in her native city as Lucrezia in the opera of "La Donna Borgia" in 1849, and her after career was one of great success, as she not only possessed a voice of great power and purity, but was an actress of much ability likewise. She made her home in London after 1858. In 1875 she visited the United States singing in "Don Giovanni" and other grand operas.

TIFFANY, Charles Lewis, American manufacturer; b. Killingly, Conn., 15 Feb. 1812; d. New York, 18 Feb. 1902. In 1837 he began his business career in New York, where in partnership with John B. Young he opened a stationer's store, to which were added Chinese and Japanese works of art and later French jewelry. The business founded on borrowed capital of $1,000 grew rapidly, the jewelry trade soon becoming the most important. In 1848 the firm was enlarged, jewels, bronzes and other articles of v rt, and to manufacture gold and silver ware. The same year when the value of the diamond was so depreciated because of the unsettled conditions in Europe, Tiffany instructed his partner, at the time being in France, to buy as many diamonds as he could. Through this venture the reputation of the house among leading diamond merchants was established. In 1851 the name became Tiffany and Company, and the firm was incorporated in 1858. Changing conditions from time to time necessitated removals farther uptown, until the business was located at the present site in 1905. Mr. Tiffany was known as the chief diamond merchant in the United States, and his country houses, also well known in London and Paris. The standard for sterling silver, 0.925 fine, now recognized throughout the entire country, was adopted by him in 1831. He was a liberal patron of the fine arts.

TIFFANY, Louis Comfort, American artist and decorator; b. New York City, 18 Feb. 1848. In early life he evidenced a strong inclination toward the fine arts; hence his parents wisely gratified his tastes and educated him for an artist. He first studied with George Inness and Samuel Coleman in New York, then with Léon Bailly in Paris. He spent five years in Europe and the Orient, and besides working in water colors and oils, devoted much of his time to the study of the decorative arts. He became interested in glass and its possibilities in the early 70's and revived the mosaic theory in the construction of colored glass windows. Believing that work executed upon this principle would give the best artistic results, but finding that the glass in the market did not have the range of color and texture necessary to carry out his ideas, he began a series of experiments through existing glass houses, but these failed to grasp his thoughts he established works of his own. He succeeded in producing not only many of the finest effects that were obtained in the past, but also discovered new formulas by which he could make glass unlimited in its range of color and texture. With this glass, which is known as "Tiffany favrile glass" he has not only made windows of great beauty, but also vases and different objects of artistic interest which at once commanded the admiration of the world. In 1878 he organized a company under the title of Louis C. Tiffany and Associated Artists, for the purpose of promoting the decorative arts in America and particularly the development of the making of colored-glass windows. This was the foundation of the business. The glass blowing branch was first established as the Stourbridge Glass Company, and subsequently the Tiffany Furnaces. The general manufacturing and merchandising began under the name of the Tiffany
TIFFANYITE — TIFFIN

Company, which in the development and
ning of its business became the Tiffany
and Decorating Company and the Allied
company which are now more generally
as the Tiffany Studios. One of his
notable works in mosaic is the Chancel
Crypt in the Cathedral of Saint John
Evangeline in New York, executed in glass
and semi-precious stones. Another
example is the interior decoration of
Madison Square Presbyterian Church
in New York. But while there are hundreds
at Tiffany windows and many
of them entirely decorated by his artists, eccle-
sical work is only one of the many branches
varied artistic achievements. In domes-
orative work his two dwellings, the city at
Madison avenue and 72d street, New
York, the "Bungalow at Briarcliff"
and "Laurelin," his country house at
Bay, L. I., are varied examples of his
uality and taste. Many of the most
cities, university halls, hotels, and
and other buildings in New York, Bos-
ton, and other large centers have been
ted by his art workers. Louis C. Tiffany
aps more widely known through his work
is, mosaics and interior decorations, as
aturally appeal to the popular taste and
attention by their exposure to public
His genius, however, has not been re-
even to these varied fields, but he has
lly sought employment wherever artistic
could give expression. His studies in
tries and his exhaustive laboratory work
advances possibilities beyond the realms of
He has worked successfully in tapestry,
other materials, pottery, metallic lust-
emals and in later years he has given
ought to art jewelry and silverware, all
ch, however, have not weaned him from
love of the brush. He was from the first,
to-day, a painter and works with his
not only in his studios in town and
t also on his annual trips abroad. After
his winter sojourns in Egypt he brought
1906 over 23 water colors which he ex-
while sailing in his dahabiya—on the Nile.
at colors and pictures in oil are fre-
ly seen in the galleries of the art clubs and
exhibitions. Among his principal can-
te: "Spring" (1886), "Scene in the Country" (1886); "Wading at Seahurst, N. J." (1876); 5; "Scene in Tangiers" (1876); "Study of
er, Brittany" (1877); 6; "Duane Street, New
(1878); 7; "In the Fields at Irvington, N. H."; 8; "The Cobblers at Beaumaris; 9; "Feeding the Flamingoes" (1888); 10; "in Morlaix, Brittany" (1890); "Market
ppers on the Nile" (1892); 11; "Street Scene in
s" (1893); 12; "Algerian Shop" (1895). Tiffany, as president of the Tiffany
president and art director of the Tiffany
Furnaces and vice-president and art di-
of Tiffany and Company, the jewelry
founded by his father. He was made a
Garden City, New York, in 1914.

TIFFANYITE. Certain bluish or bluish-
white diamonds, principally from Brazil, al-
though a few have been found in India and
South Africa, phosphoresce for a consid-
time after having been exposed to bright sun-
light, electric light, or other brilliant rays.
This property results from the inclusion in the
diamond of a hydrocarbon or a rare earth, and
for this class of diamonds the New York
Acaemey of Sciences (1890) has given it the
name "tiffanyite." 12

TIFFIN, Edward, American physician,
preacher and politician; b. Carlisle, England,
June 1776; d. Chillicothe, Ohio, Nov. 28, 1829.
About 1786 he went to Charlestown, Va., and
in 1789 was graduated in medicine at the Uni-
versity of Pennsylvania. Three years later he
became a local preacher in the Methodist
Church, likewise studying law and engaging in
the practice of medicine. About 1797 he re-
moved to Chillicothe, in what was then the
Northwest Territory, was elected to the Terri-
torial legislature and in 1799 was speaker. He
was chosen president of the convention which
framed the State constitution (1802), and be-
came first governor (1803—07) of Ohio.
The town of Tiffin in that State was named for him.
He arrested the Burr-Blennerhassett expedition
in 1808. (See BLENNERHASSETT, HARMAN; BURL, AARON.) He was a United States sena-
tor in 1807—09, resigned in the latter year to
assume the speakership of the Ohio legislature.
He was the first commissioner of the General
Land Office (1812), and at the burning of the
National Capitol by the British in the art work
papers from destruction. In 1815 he was made
surveyor-general of the Northwest Territory
and continued in that office almost until the
end of his life.

TIFFIN, Ohio, city, county-seat of Seneca
County, on the Sandusky River and on the
Baltimore and Ohio, the Pennsylvania and the
Cleveland, Cincinnati, Chicago and Saint Louis
railroads, about 80 miles north by west of
Columbus, the State capital and 40 miles south-
east of Toledo. It was settled in 1817 by Eras-
tus Bowe, and incorporated in 1835. In 1836 it
was chartered as a city. It is the commercial
and industrial centre for a large portion of the
country, in which are many fine farms. In the
vicinity of Tiffin are deposits of clay and glass-
and. The chief manufacturing establishments
of the city are machine shops, glass works, pot-
teries, wagon and carriage works, motor truck
works, gloves and mitten works, candy factories,
breweries, iron works, planing mills, emery-
wheel works, flour mills and furniture factory.
There are about 5,000 employees in the city's
manufactories. The principal public build-
ing are the courthouse, the municipal build-
gs, the churches and schools. There are 16
churches, representing 10 denominations, and
TIFLIS — TIGER-CAT

Saint Francis Hospital and Home. The educational institutions are Heidelberg University (Reformed), opened in 1850 (nearly 650 students in 1915), Ursuline College, public and parish schools and two librarieis. Tiflis is the location of the national home of the Junior Order of United American Lineage, containing about 400 children. The four banks have a combined capital of $500,000; the annual business done through the banks amounts to over $3,000,000. The government is administered under a board of public safety, board of public service and council of seven members elected by wards and at large. Pop. 14,256.

**TIFLIS,** tif'les', Russia, the capital of the government of Tiflis in the general government of Caucasus (see Transcaucasia), situated at the southern base of the Caucasus about midway between the Black and the Caspian Seas. It is picturesquely built on terraces rising from the valley of the Kura, and surrounded by orchards and vineyards. Some walls and towers of the old fortifications remain, and there are parks and botanical gardens. Among the numerous churches the most interesting is the cathedral of Zion, dating in part from the 5th century. Other notable buildings are the palace of the governor-general, the Caucasian museum and library. The educational institutions include nearly a dozen high schools, besides numerous technical schools, one of the foremost of which is the finely equipped school of commerce. The chief industries are the manufacture of leather, oil, silk, woolens, clothing, and, more especially, wines and several breweries and distilleries. Commerce has declined somewhat, though the city is connected by rail with both the Black and the Caspian Seas. Pop. 27,900.

**TIGER,** the largest and most admirable of the cats (*Felis tigris*). In size and power it surpasses the lion, as it does in beauty, and expresses the highest type of feline structure. (See FELINE.) The ground color of the body is a bright tawny yellow, bearing black stripes running at right angles with the general axis of the body and having their inner aspect in the limbs are white, as also are the throat and chest. On these white parts the stripes are lighter, and gradually merge into the white color. The tail is not tufted at its extremity, and is usually of lighter hue than the body, with dark rings. White or allino varieties of the tiger have been found, as also black ones. The maximum length, including the tail, is about 11 feet, and the largest weigh about 500 pounds. The tiger attains its full development in India, the Bengal variety being the largest and most typical; but it also occurs in southern Siberia, Turkistan, Persia, Java, Sumatra, China and Japan, encountering a range of climate from tropical to sub-arctic conditions. In habits these animals are far more active and agile than the lion, and exhibit a large amount of fierce cunning. They generally select the neighborhood of water-courses as their habitat, and spring upon the animals that come to drink from it, or even to more retired spot to be devoured. The march of the animal through the thick brushwood of the jungles in which it lives is noiseless and stealthy, and it appears rather to avoid than to court danger, although, when brought to bay, no animal presents a fiercer front than the tiger. Where deer, antelopes and wild hogs are abundant, domestic animals are comparatively safe, but otherwise the tiger is ready enough to prey on the latter. When pressed by hunger or enfeebled by age and incapable of dealing with larger prey, the tiger prowls around villages, and, having once tasted flesh, becomes a confirmed cattle-lifter and man-eater, sometimes causing the temporary abandonment of a large district by the terror-stricken inhabitants; and in several historic instances districts of country in southern India, Indo-China and the adjacent islands have been deserted premonently because so infested with tigers harbored by neighboring swamps and jungles. The number of persons killed by tigers each year in India averages about 930, mostly in Bengal, Madras, Central Provinces, Assam and Burma. About 32,000 head of cattle are also killed annually in India by tigers.

The natives destroy tigers by traps, pitfalls, spring-guns and poisoned arrows, but the orthodoxy box method of keeping down numbers as pursued by Europeans is to employ dogs to beat the bush while the game, when started, is shot by the sportsmen seated on elephants. The sport is exciting, but dangerous; for a wounded tiger has been known to spring on an elephant and to inflict serious wounds on the driver and occupants of the howdah, before it could be dispatched. A safer and more common method is to tether a live goat, or otherwise set a bait in a place where a tiger may be expected, then erect a platform on poles or in a tree near by, and await the animal's approach on a night when moon or stars shed light enough to enable the watcher to shoot his prey.

These great cats have always been kept as a captivity by Oriental rulers, and now and then have been completely tamed. They have been a feature of every menagerie and animal trainer's show since such collections began to be formed, and as they readily breed in captivity the supply will easily be maintained. Consult Baker, 'Wild Beasts and their Ways.' (London, 1890); Lydekker, R., 'The Game Animals of India' (ib. 1888); Lydekker, R., 'The Game Animals of India' (ib. 1907); Porter, 'Wild Beasts' (New York 1894), and books on sport and travel in India and the East Indies.

**TIGER-BEETLE,** a beetle of the family **Cicindela,** in which the head is wider than the thorax, and the terminal hook of the mandible jaws is jointed at its base. This insect is swift and active, and preys upon other insects. It is very often found in sandy places and the large live in straight deep burrows in the ground. The color varies, corresponding as a rule to the general coloring of the surroundings. This beetle is more common in the tropics. Over 1,500 species are known, less than 100 of which have been found in the United States. Some species are wingless. See plans accompanying the article *Insecta*.

**TIGER-CAT,** a name of not very definite signification, and given to those animals of the family *Felidae* which are of medium size and somewhat resemble the tiger in form or markings, such as the chati, margay, serval, etc. In America the ocelot (q.v.) is most often meant. The marbled tiger-cat is a small bea-
variegated species (*Felis marmorata*) eastern Himalayan region.

**ER-EYE**, a semi-precious, chatoyant f blue, yellow or brown color, which a charming change of colors when re-
it. The original mineral is changedration of silica and when accompaniedoxidation of its iron its blue color is to severe brown. It is extensivelywatch charms, cuff buttons and manyarticles which are largely sold at manyresorts, often, though fraudulently, asorigin, the mineral being found only inSouth Africa. See Crocodile.

**ER-FLOWER**, a Mexican plant (*Tig-nonia*) of the iris family, frequently used for the brilliance and oddity of its These are solitary, terminal and cup-
in the centre, but have a wide-spread, formed by the three oblong clawed x of the perianth, which are the largest, brilliant red at the outer edge, shading n, spotted with reds and purples at the 'he three inner segments are fiddle-
The flowers are fugacious, lasting only a day, but there is a long succession of there are many varieties of these Ti-in which the hues of the corollas range various shades of yellow to white. m is about a foot high, slightly zigzag nched; and it bears a few alternate dis-
se, the greater number of the leaves dical and sword-shaped. The internode ed to be lifted into a dry place out of f frost during the winter, as they are rdy in the northern United States. s are propagated by seeds or offsets. re other species of the genus, which are ransome or conspicuous as *T. pavonia*; them have bluish flowers.

**ER LAKE.** See Nahuel-Huapi.

**ER-LILY.** See Lily.

**ER-MOTH**, one of the large moths of *Arctia*, the caterpillars of which are as "woolly ears" because of their own ears, and known as "wooly ears."n
**ER SHARKS**, a shark (*Stegostoma*) common in the Indian Ocean. The wn fish, from 10 to 15 feet long, fre-
t open sea. The color is a yellowish-
with black or brown transverse r spots.

**ER-SNAKE**, a large blackish, yellow elapid poisonous serpent (*Notechis*), widely disseminated in australia and ia, and very numerous.

**HE**, ti, *Mary* (Blachford), Irish poet: in, 9 Oct. 1772; d. Woodstock, County y, 24 March 1810. She was married to Sir, Henry Tighe, in 1793. Though her Psyche, or the Legend of Love, was 3 printed (1805), it was only after her at her complete writings were published. st edition was in 1811, and they have been reprinted. "The 'Psyche' is in the Spenserian stanza and is founded story of Cupid and Psyche as narrated Golden Ass of Apuleius. Her other are chiefly of a religious cast. It is as the subject of Moore's lyric, "I saw thy form in youthful pride" and of Mrs. Hemans' "Grave of a Poetess," that Mrs. Tighe will be longest remembered.

**TIGRANES** (*tig-rá-néz*) I, king of Armenia, 96 to 55 B.C. A descendant of Artaxias, the founder of the Armenian kingdom, he brought under his rule large accesses of territory in Syria and Mesopotamia, and in 83 B.C. had acquired most of the provinces of Syria from the Euphrates to the sea. By his marriage with the daughter of Mithridates, king of Pontus, he formed an alliance with that monarch disastrous to the smaller kingdoms of Asia Minor. He invaded Cappadocia in 78 and completely subjugated its inhabitants. Other wars followed and Tigranes became the mightiest king in Asia. He built the new capital, Tigranocerta, whither he transplanted the inhabitants of many captive places, including Cappadocia, Syria and Cilicia. His possessions were wrested from him by the Roman general Lucullus, but were nearly all recovered by Tigranes, only to be lost again to Pompey in 66. In the final defeat of Tigranes, Pompey was aided by the rebel son of the Armenian king, who claimed the throne. The troops of Gordyene and Sophene for himself. Tigranes was able to retain only Armenia proper, for which he was obliged to pay Pompey an enormous sum and to subsidize the entire Roman troops under him. Tigranes was succeeded by his second son, Artavastes. Consult Reuchel, T, 'Mithridate Eupator roi de Pont' (Paris 1890).

**TIGRIS**, *tigrís*, Asia, an important river which rises near the Euphrates (q.v.) from two sources. The western and chief branch rises near Kharput, and under the name of Dejleh or Shatt, flows southeast. After passing Diarbekir it receives the eastern branch, flows past Mosul and Bagdad and joins the Euphrates at Kurna; together they form the Shattal-Arab and thus enter the Persian Gulf. The stream waters the ancient Nineveh, and separates Assyria from Mesopotamia on its way to Bagdad. It is only navigable for small boats and its entire length is 1,150 miles. Keels, or large rafts, supported by inflated skins, are much in use for the transportation of freight. The chief tributaries are the Greater and Lesser Zab and the Diyala. The biblical name of the river is Hiddekel.

**TILDEN, Douglas**, American sculptor: b. Chico, Butte County, Cal., 1 May 1860. He lost his hearing in early life and was graduated from the State Institution for the Deaf in Berkeley, Cal. (1879). Taking up the study of sculpture in 1887 at the National Academy of Design, New York, and later abroad, he was appointed a member of the jury on sculpture at the World's Columbian Exposition in Chicago. He was elected a member of the National Sculpture Society, the New York Art Club, the San Francisco Art Association, etc., and was professor of sculpture at the Mark Hopkins Art Institute (1894-1900). His works include 'Base-Ball Player'; 'Tired Boxer'; 'Indian Bear Hunt'; 'Football Players', etc.

**TILDEN, Samuel Jones**, American lawyer and statesman: b. New Lebanon, N. Y. 9 Feb. 1814; d. Greystone on the Hudson, near Yonkers, N. Y., 4 Aug. 1886. He was educated at Yale and at New York University, being graduated from the latter in 1837. He then
studied law and was admitted to the bar in 1841. He attained the first rank in his profession, being particularly successful in reorganizing corporations involved in litigation, and amassing one of the largest fortunes ever gained in the practice of law. While a student in college, he had taken an active part in politics, writing and speaking in favor of Martin Van Buren's policy; in 1845 he was elected to the New York State legislature and was a member of the committee to consider the settlement of anti-rent troubles. His report on the subject forming the basis of subsequent legislation. In 1846 he was a member of the State constitutional convention and in 1848 was one of the delegates of the Free Soil faction of the Democratic party to the National Convention, but his political activity then slackened until after the Civil War. During the war, however, he was several times consulted by President Lincoln; he believed that the war, once begun, must be carried through by the Federal government, but opposed any acts of the administration as unconstitutional. In 1866 he was made chairman of the Democratic State committee and in 1867 was a member of the State constitutional convention. As chairman of the State committee he took a leading part in the overthrow of the Tweed Ring, opposing their delegates in the State conventions and being active in collecting evidence against their leaders and bringing them to prosecution; in 1872, having been elected to the State legislature, he was the leader in the impeachment of two of the Tweed judges. (See TAMMANY SOCIETY; TWEED, W. M.). In 1873 he resigned as chairman of the State committee; but in 1874 was nominated and elected Governor of New York. His administration was notable for his successful exposure of the "canal ring," an association made up of persons who obtained contracts for canal work which they never fulfilled, but for which they were paid, and their political supporters. Governor Tilden employed a skilled engineer to examine their work and then surprised the legislature by a word and special message setting forth in detail the fraudulent methods of the "ring." This served as a direct appeal to the people; and so aroused public opinion that the legislature was forced to authorize the governor to appoint a calls for their Commission. The report of this commission resulted in a marked diminution in the appropriation for canals and the indictment of several officials for defrauding the State. In 1876 Tilden was the Democratic nominee for President of the United States, and received the largest popular vote, but lacked one electoral vote necessary for his election. As the electoral votes from several States were contested on account of alleged fraud, the matter was referred to a special Electoral Commission made up of members of the Republican candidate, Rutherford B. Hayes. (See ELECTORAL COMMISSION). Popular excitement had run high and many Democrats still claimed Tilden's election, but he urged his supporters quickly to cut down the size of the commission. In 1880 and 1884 his party again wished to nominate him for the Presidency, but each time he declined the nomination. He bestowed the most of his fortune to establish a public library in New York, but the will was contested by the heirs and only a part of the request came into the city's possession. (TILDEN FOUNDATION). Consult 'Writ Speeches of Samuel J. Tilden' (ed. by Bigelow, 2 vols., New York 1885); 'Lehman Literary Memorials of Samuel J. Tilden' by John Bigelow, 2 vols., ib. 1908; J. 'Life of Samuel J. Tilden' (2 vols., 1895); Haworth, 'Disputed Presidency of 1876' (Cleveland 1906).

TILDEN, (Sir) William Augustus, a scientist: b. London, 15 Aug. 1842. He graduated in various schools of the College of Chemistry; in 1864 became stratographer of the Pharmaceutical Society, 1872-80 science master at Clifton College; in 1888 professor of chemistry, Mason College; in 1890-91 president of the College of Chemistry, 1891-94; treasurer of the Society, 1899-1903 and president, 1903-05; professor of chemistry, Royal College of Science, London, 1894-1900, and dean of the college, 1903-1905; emeritus professor in the Imperial College of Science and Technology, 1908. He was awarded the Hon. medal of the Royal Society, the numerous scientific papers and in books: 'Introduction to Chemical Philosophy' (1889); 'Practical Chemistry' (1888); 'An Introduction to the History of Chemistry' (1891); 'A Manual of Chemistry' (1890); 'A Short History of the Progress of Scientific Chemistry' (1899); 'Elements' (1910); 'Chemical Discovery Invention in the Twentieth Century' (1908); and 'Sir William Ramsay' (1918).

TILDEN FOUNDATION. The, the integral components of the New York Public Library Fund. By the will of S. J. Tilden (q.v.) the bulk of his property left for the establishment of the Tithe Trust Fund to found a free public library and museum in New York. This will was contested long in the courts and was broken in the property being decreed to the heirs of William B. Hazard, one of the latter. At the hearing of this decision he relinquished about $2,000,000 of his property in order that Tilden's wishes might be out to some extent. In 1893 an agreement was reached whereby the trustees of the Astor Library and the New York Public Library agreed to unite their properties into one New York Public Library. The Astor, Lenox and Tilden Foundations city of New York subsequently agreed to the site of the old Astor Library, 40th to 42d Street on Fifth avenue, a spacious and spacious structure for these libraries. The work was begun in 1900 and completed in May 1911. See L.

TILEFISH, a large oceanic fish (timius chameleonpticus), allied to the alimentary to the family Malacombria, described by the planquilla and other flat-fishes of the Pacific coast, from 10 to 40 pounds and is big-brilliantly colored, with a curious...
ely deep water to the southward of an inlet and on the edge of the Gulf where it was taken in considerable num-
n the spring of 1882 vessels arriving at ar reported having passed through great 
 fish and during fishing, the water
muckly dotted with them for miles. From
in brought in, it was found that the ma-
ese were tilefish, while from the re-
various vessels it was shown that the
vered by dead fish amounted to some-
months worth of 7,500 and a total number of dead estimated at
from a billion. This enormous and
ad destruction is believed to have been
by an unwonted duration of northerly
stier winds, which drove the cold
urrent inshore and southward, chilling
belt in which the tilefish resided and
ill in that locality. It was thought pos-
it the entire race might have been de-
, while none were taken for many
1899 and 1900 a number were caught,
that the species was beginning to re-
the waters from which it had been
years before. Consult Lucas, 'Animals
ast' (New York 1902) and 'Reports'
illeged by the New York Fish Com-
especially for 1884 and 1899.

ES are stone, metal or composition
use in covering a roof to keep out
. Since the most common material is
lay, and this same clay is used to form
the word tile has been extended in
to cover clay pipes termed drain-tile.
me baked clay is often colored and
ore side, giving it a glazed finish often
beauty. Such colored and glazed tiles
for interior walls, dadoes, floors, man-
. Drainage tiles are made of native
tually glazed inside. Each tile has at
an extended rim which overlaps the
of the tile next to it, thus forming a
us pipe. Roofing tiles take the form
flat shingle or slate-like slabs or of
sea pan tile shows a al-like curve, one side of the tile heing
and the other convex — the latter curve
ver the concave curve of the next tile,
on. In this manner there is no opening
ice weather. The same principle is
plied to the flat tiles and to ridge tiles,
ear on one edge a semi-circular convex
on the other a concave one. Ridge tiles
e in angles to fit and cap the ridge-pole
, to turn corners and to ornament pro-
Roof tiles are glazed or dull, accord-
gr make's fancy, and are used in varie-
colors. Modern taste seems to prefer
highly glazed saffron or terra-cotta
el dark dull flat ones. But dur-
Renaissance and until recent years
ored glazed roof tiles either in the
corrugated style were in large demand
out southern and central Europe. Fine
s of decorative roofs are preserved
Middle Ages, and a notable example being
Saint Stephen's Cathedral in

Such tiles are often enameled and are
dered waterproof. Slate, marble and
of tiles are occasionally employed.
ior tiles are made in great varieties of
sizes, colors and materials, ranging
from fine brick-clay tiles to those of enameled
and painted porcelain. They are used for
vements, flooring and revetments to walls.
Old houses in the south of Europe were
commonly paved with red brick-tiles baked hard
and sometimes glazed. The method of decora-
tion usually employed was to inlay clays of
different colors in the bodies of the tiles, pro-
ducing designs often of great beauty. Enameled
tiles were used in the 15th and 16th centuries
for the pavings of interiors of importance, such
as chapels, chambers of honor, etc. These
thin, enameled tiles broke easily and only a few
examples are to-day preserved in the cathedrals
and castles of France and Italy. The use of
tiles for wall revetments and for dados was
not general during these periods but has grown
in recent years. Modern wall tiles are usually
painted or glazed and are of various fine clays,
not infrequently of porcelain. Large wall
spaces are covered with painted tiles in pic-
torial or decorative composition, the work of
Théodore Deck affording some fine examples.
Tiles with slightly raised figures are also used,
the style having been borrowed from the Persians
who are masters of their manufacture.
A recent effective use of colored clay tiles may
be seen in the subway stations in New York,
where especially pleasing effects have been in-
expensively produced by the judicious selection
and blending of colors. Modern usage does
not follow the example of the Middle Ages
in the employment of carved and leaded marble
tiles. In these latter the variously shaped
slabs of stone were incised with intricate and
elaborate designs and the incisions filled with
lead or colored compositions and sometimes
with fine mosaic work. Consult Church, W. A.,
'Patterns of Inlaid Tiles,' etc. (1845); Herdile,
H., 'Vorlagen für das polychrome Dach-
onornament' (1885); Jones, Owen, 'Designs in
Mosaic and Tesselated Pavements,' etc. (1842);
Monteaux, Henri, 'Les carrelages historiques
du moyen-âge et de la renaissance,' etc. (1887);
Wallis, Henry, 'Italian Ceramic Art,' etc. (1902)
and the papers of Ricardo, H. R., on
'Architect's Use of Enameled Tiles' (in

TILGHMAN, Thomas, Mathew, American
patriot; b. Queen Anne County, Md., Feb.
1718; d. Talbot County, Md., 4 March 1790.
He was a member of the Maryland assembly in
1751 and as a magistrate and prominent member
of Talbot County was a member of the
committee which drew up the Maryland pro-
test to the Stamp Act. In 1774 he was made
president of the Provincial Congress or Con-
vention which controlled the affairs of the
colony until its statehood, and in 1777 repres-
ented Talbot County in the Provincial Senate.
He was a delegate to the Continental Congress
1775—77 and was throughout the entire pre-
Revolutionary period a staunch defender of
the cause of independence and an able advocate
of civil rights.

TILGHMAN, Tench, American soldier,
nephew of M. Tilghman, q.v.; b. Queen
Anne County, Md., 25 Dec. 1744; d. Baltimore, Md.,
18 April 1786. His career as a merchant in
Philadelphia was interrupted by the Revolu-
tion. He joined the Continental army at the
outbreak of the war and was one of the of-
cers sent to confer with the Six Nations.

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1776 he was appointed aide-de-camp to Washington, in which position he continued to the close of the war and in this capacity was entrusted with the hearing of the surrender of Cornwallis at Yorktown on 19 Oct. 1781. In May 1781 he was made lieutenant-colonel to take rank from 1 April 1777. At the close of the war he settled in Baltimore, where he again took up a mercantile life. Consult 'Memoir of Tench Tilghman' (Albany 1870).

TILIACEAE, a family of trees, the lindens, with some shrubs and a few herbs, mostly indigenou to the tropics, especially in South America and Asia. A few are natives of the north temperate zone. The chief genus is Tilia, characterized by alternate, simple leaves; solitary or variously grouped axillary flowers with four or five sepals and petals, numerous stamens with two-celled anthers; and several-celled capsules or drupes. One of the most striking peculiarities of the family is the abundance of resinous substances in various parts of the plants, particularly in the young twigs, inner bark and buds. On this account several species are valued for stock-food. Many of the species are noted for their tough fibrous bast, often used for making cordage, bagging and even fine fabric. It hardens in the sun or in the steam in a contempot time, could find a place than that of court fool, the sanction of Nuremberg shoemaker's optimistic social regeneration.

That Hans Sachs should be bor this action at all is enough to it. Lienhard was less concerned for the beauty of his plot than for its atmosphere. I is probable that in Eulenspigel's there should be so sene and resolute a girl as Gertrude, to whom he is sincere voted, it is improbible that his love should not have sufficed to steady him. "stranger of the episode he finds - mean oblivious of Gertrude - a kindred daughter of an innkeeper. But wagerer has carried him from an artful like to the point of realizing this spiritual it seems to see no incongruity in abas the girl to the commonplace lover who has promised to marry, in case she bet. However, neither the plot nor the comedy, of which there is no lack, gives work its chief significance. The moral Eulenspigel is a Diogenes. It is his fault if, in his search for an honest does not even find himself.

WILLIAM G. H.

TILLAGGE. See Agriculture in United States.

TILLETT, Benjamin, English labor b. Bristol, 1859. He was employed in and brickyards from the age of eight; went to sea at 12 and served in the navy two years after he was 17; being then in out of the service. He later became a cooper and in 1887 was one of the of the Tea Cooper's and General Association. He was a large organization of the Dock, Wharf and Laborers' Union of Great Britain; and became its secretary. He was one of the leaders of the Great Dock Strike for many years an alderman of the County Council, and was several times a successful candidate for Parliament as a loyal worker for maximum production of the European War and was one of the members sent to visit the Western Author of 'Trades Unions and', 'History of the London Workers' Strike, 1911 (1912).

TILLETT, Wilbur Fisk, America dist theologian b. Henderson, N. C. 1854. He was graduated from Randolph College in 1877 and from Princeton Seminary in 1880. He held a pastorate in Danville, Va., 1880-82 and has been of systematic theology at Vande since 1884 and since 1884 and vice-chancellor of the University. He has published 'Our Hymns and the Authors' (1899); 'Discussions..."
TILDELENSPIEGEL — TILLOTSON

(1900) "Personal Salvation" (1902) "The Doctrines of Methodism" (1903) "A Statement of the Faith of Worldwide Methodism" (1906) "Hymns and Hymn Writers of the Church" (with C. S. Nutter, 1911).

TILDELENSPIEGEL, t'il"d'en-spe-gel, a series of stories collected and first published in 1843. See EULENSPIEGEL; TILL EULENSPIEGEL.

TILLITE, a rock consisting of a heterogeneous or non-stratified mixture of boulders and sand, supposed to have been glacial till originally. The name was given by Davis to beds in the South African Permian succession believed to have been of glacial origin. Shantum tillite is a member of Roxburg Conglomerate in eastern Massachusetts of Carboniferous, possibly Permian age. See TILL.

TILLMAN, Benjamin Ryan, American legislator: b. Edgefield County, S. C., 11 Aug. 1847; d. Washington, D. C., 13 July 1918. He received his education at Bethany Academy, entered the Confederate army on the outbreak of the Civil War, but was obliged to forego active service owing to a severe illness. The war found him undertaking the management of his mother's farm in the back country, a farmer in spirit and life. During the troubled days of Reconstruction he played his part in the reprisals of the whites. In the '90s a political situation developed in South Carolina, which finally landed Tillman in the governorship. The aftermath of war and the persistence of caste lines put a widening gulf between the aristocrats of the seaboard plain and the back country people of the mountains. With the overturning of the Republican domination the patrician class began to resume once more oligarchic rule of the State. There were mutterings of discontent among the mountaineers and farmers in the backwater districts. As champion of the latter Tillman suddenly found himself thrust forward. In 1890 in the most bitter campaign in the State's history he was elected governor. From the day of his inauguration to the end of his second term South Carolina was a constant ferment. There was one incident of his rule that stands out among all the other turbulent affairs was his promulgation of the famous dispensary law and the events following it. This law gave sheriffs and constables power to enter stores and private houses and to seize any liquors found there which did not bear the stamp of the State. Riots occurred; Tillman ordered out the militia; some companies refusing to obey this summons were publicly degraded, and conditions bordering on anarchy existed, but the law stayed and the governor was triumphant. Tillman soon became a national figure. He took a prominent part in the State Constitutional Convention of 1895, which set an educational qualification for the franchise, and by his violent attitude against the negro he became the object of attack by Northern sentimentalis. He was a bitter opponent of Cleveland; his speeches against the latter gaining him the nickname of "the New York Beak." In the visit of the insurgent conventions of 1896, 1900 and 1904 Tillman was the stormy petrel who raged at all who opposed his views. In 1894 he was elected to the United States Senate and was re-elected in 1900, 1906 and 1912. His terms in the Senate were marked chiefly by the quarrels he had. Cleveland he had hated and it was not in the realm of possibility that he and Roosevelt could be other than enemies and enemies they frankly were during Roosevelt's incumbency of the Presidency. In his later years Tillman became less and less the hugaboo in the eyes of the people who had at first opposed him with all of the bitterness of caste and class. As he broadened into a national figure and in the Senate fought the fight of the whole South with untinged vigor, he was first denigrated, then respected by all the people of his State. The closing years of his life found him chairman of the Senate Committee on Naval Affairs, perhaps the second most important governing body in the country, and as such he worked incessantly for the building up of the navy. He advocated a greater navy, government armor-making plants, etc., and warned manufacturers that the government would force them to stock fairly. He supported his friend, Secretary Daniels, maintaining publicity and private that Daniels was a misunderstanding, much underestimated man who would prove his worth in time.

TILLMAN, Samuel Escue, American soldier and author: b. near Shelbyville, Tenn., 2 Oct. 1847. He was graduated from West Point in 1869, and assigned to frontier duty. In the following year he was called to West Point as assistant professor of chemistry, and was later appointed professor of mineralogy and geology. He continued to teach in the Military Academy for many years, being retired by operation of law on 2 Oct. 1911. In 1874-75 he served as a member of the United States expedition to Tasmania to witness the transit of Venus. He was recalled to active duty on 6 June 1917 and assigned to duty as superintendent of the United States Military Academy. He is the author of 'Essential Principles of Chemistry' (1884); 'Elementary Mineralogy' (1884); 'Elementary Lessons in Heat' (1889); 'Descriptive General Chemistry' (1889); 'Important Minerals and Rocks' (1900), and other textbooks.

TILLODONTIA, a group of extinct mammals, chiefly of the North American Eocene rocks. They were large plantigrade, five-toed land animals, whose skeleton presents characters intermediate between those of Carnivora and Rodentia. The brain is small and slightly furrowed. The dentition was complete and marked by large, rodent-like incisors. A prominent genus was Tillotherium. See Rodentia.

TILLOTSON, t'il"tson, John, English prelate, archbishop of Canterbury: b. Sowerby, Yorkshire, October 1630; d. 22 Nov. 1694. His father, a strict Calvinist, brought up his son in the same principles. He was graduated at Cambridge and elected a Fellow of Pembroke College in 1651. In 1666 appeared his "Rule of Faith," a reply to a work by John Sergeant, an English clergyman, who had made a convert to the Catholic faith. In 1670 he became prebendary of Canterbury. When Charles II, in 1672, issued a declaration of indulgence for the purpose of favoring the Roman Catholics, he preached strongly against it, but was, nevertheless, advanced to the deanship of Canterbury, and three years after (1675) presented to a prebend in Saint Paul's. On the accom-
TILLY — TIMBREL

PLEishment of the revolution he was taken into favor by King William, and in 1689 he was appointed captain of St. Paul's. On the suspension of Archbishop Sanerfoft as a non-juror he was appointed to exercise the archiepiscopal jurisdiction, and in 1691 accepted the archiepiscopal see. He had previously formed an abortive scheme for the comprehension of the Presbyterians within the Church, and had also failed in another design for forming a new book of homilies. When, therefore, he accepted the primacy, a large party assailed him with great animosity. He bore these attacks in silence, and even prevented some prosecutions for libel against him, directed by the Crown. He was also charged with Socinianism; in answer to which he republished four of his sermons on the Incarnation and Divinity of Our Saviour. The only class to whom he did not show a mild and tolerant spirit was the Roman Catholics, toward whom he had a strong aversion. Tillotson's sermons were for half a century the most popular of that class of compositions in the English Church, but have since fallen into neglect and even disuse. In other respects than that of style they are generally commended for benignity of spirit rather than depth or richness of thought. An edition of his sermons was published by his chaplain, Dr. Ralph Barker (14 vols., London 1695-1704). Consult also Birch, Thomas, Life (London 1752).

TILLY, tīl′ (Fr. tê-yé), Johann Tserkaes, Count of, Bavarian commander: b. Castle Tilly, Brabant, near Belgium, February 1559; d. Innsbruck, Bavaria, 30 April 1632. He received a strict Jesuit education, but preferring life in the army he became a soldier of fortune in the service of Span, and later in that of Austria, after which he attached himself permanently to the Bavarian army, and under the banner of its king, the head of the Catholic League, entered upon the Thirty Years' War. His first signal victory was that of White Mountain, 6 Nov. 1620, when he defeated the Protestants in Bohemia. He was victorious over Christian of Brunswick at Hochstr (1622) and Stadthorn (1623), thus gaining the title of Count of the Empire. In 1626 he compelled Christian of Denmark, who had joined the Protestant forces in Saxony, to retire into his own domain. In 1628, as commander of the Imperial army and in 1631 won the famous battle of Magdeburg against Gustavus Augustus of Sweden and the Saxo Protestants. In the following September the Bavarian troops were, however, completely routed by the Swedes at Breitenfeld, and in the engagement upon the river Lech, April 1632, Tilly, who had been victorious in 36 battles in the religious wars of Germany, was mortally wounded. Consult Klop. O. T., Tilly in Preissigiahrigen Kriege (Stuttgart 1801); Villermont, Tilly ou La Guerre de trente ans (Tournay 1859); Wittich, K., Magdeburg, Gustav Adolf und Tilly (Berlin 1874).

TILSIT, Germany, a town in East Prussia, at the mouth of the Memel or Niemen, and the Whehr at its north-east of Königsberg. Its principal buildings are the gymnasium and schools, a theatre, barracks, castle ruins and other institutions. The chief manufactures are iron castings, machinery, paper, soap, candles, coal, chemicals, cloth, leather and tobacco. The ced and salmon fisheries, important, as well as the large stock. At Tilsit the famous peace ending the French-Prussian War was concluded (1815). See WAR, European Pop.

TILTON, Theodore, American jou r, b. New York, 2 Oct. 1835; d. Paris, France, May 1907. He was graduated from the College of New York in 1855 and became a journalist on the New York Daily. In 1856 he joined the editorial staff of Independent, and in 1853 became its editor in chief. In 1871 he became an editor of the Brooklyn Union, but shortly after entered the New York World. In 1874 he caused a sensation in Plymouth Church, Brooklyn, by the Rev. Henry Ward Beecher of the W. a. New York, 2 Oct. 1835; d. Paris, France, May 1907. He was graduated from the College of New York in 1855 and became a journalist on the New York Daily. In 1856 he joined the editorial staff of Independent, and in 1853 became its editor in chief. In 1871 he became an editor of the Brooklyn Union, but shortly after entered the New York World. In 1874 he caused a sensation in Plymouth Church, Brooklyn, by the Rev. Henry Ward Beecher of the Press. He was the author of several poems, including 'The Sexton's Tale and Other Poems' (1867); 'Thou and I' (1880); 'Swabian Sonnets' (1882); 'The Child's Lullaby' (1889); 'The Senate's Last Soul' (1894); 'The Heart's Ease' (1894); and 'The Fading of the Flower: A Poem' (1906).

TIMARU, a New Zealand town on an island in the geographical country, on the coast 100 miles by rail southwest of Christchurch, is an important railroad centre, being at the very junction of the Fairlie line. The principal exports are flour, wool and meats. Timaru has a fine harbor. Pop. 6,424.

TIMBER AND STONE LAW. (June 1878) Congress passed the Timber Stone Law which with certain amendments is now in force. Under this law all unappropriated, unmineral surveyed lands within the public land States are chiefly valuable for the timber or stones and until for cultivation they may be sold at their appraised value of not less than $2.50 per acre. One tract of stone entry may be made for not more than 160 acres (a) by any person who is a citizen of the United States or who has declared his intention to become such citizen, if he is under 21 years of age and has not previously been convicted of any felony; or (b) by an association of such persons to be formed by a corporation of three or more, each of whose stock is so qualified. Provision is made for an appraisement of the value of the stone on the land in question and a lien must be issued in accordance with such appraisal.

TIMBREL, a musical instrument resembling a tambourine (q.v.), has been used in the earliest times. It is mentioned —
TIMBUKTU — TIMBY

made of iron, the idea of which was suggested to him when first he observed the twin-peaked drum of Egypt or the long narm of Provence, to the modern tam-tam of Spain.

BUKUTU tim-buk'too (also spelled Timbuctoo), French Sudan, a trading station situated on the great Niger River, on the southern border of the Sahara, in lat. 16° 43' N., and 57° W. The city lies in a desert region nine miles from the banks of the river feet above sea-level. It measures three circumference, and consists of adobe without windows. In the centre are the mosque, and on the northern outskirts the commerce by caravans the Saharan was formerly enormous, is considerable and again increasing, being at $4,000,000 annually. The trade is silk, fabrics, hardware, ostrich feathers, cotton, tobacco, sugar and gold. Recent on the present Egyptian frontier pointing to a prehistoric foundation, the modern city was founded toward the 11th century, and became known in 1533. Due to its former access Timbuktu was long an obscurer center, the seat of the sultan of the Futa Jalon, who captured the city and adjacent town 1390, deposing the native Songhoy king. At the Moroccon was off, and various tribes controlled the river, the French took possession of it in 1603, and the telegraph line connects with Algeria. The military territory has its headquarters Pop. (1917) about 16,000,000, almost all Negroes. Consult Dubois, 'Timbuctoo, Timbuctoo, Timbuctoo, Timbuctoo' (1905); Lady Luard, 'A Dependency' (London 1905).

BY, Theodore Ruggles, American in-b. Dover, Dutchess County, N. Y., 5 22; d. Brooklyn, N. Y., 1909. He was a shipbuilder, and invented the floating dry dock. Among his other contributions was the latter, iron and steel for coast-defense; a of sighting and firing heavy guns by y, patented in 1862 at Washington, adopted by the United States government and now used in all leading countries; electric turbine wheels; the first portable telephone; the process of printing terrestrial n colors; and a process for quickly coffee. He was the first to advocate the use of iron in the construction of ships; his most famous invention is the z turret which was first introduced in naval Monitor (see Monitor, the and Merrimac), and has since been in naval architecture throughout the world. This invention, through official neglect or refusal to recognize it, has been awarded to John Ericsson (q.v.), given the title of the Monitor. But the true case shows that as early as 1841 exhibited at the War Department a nd plans of a revolving battery, to be

In 1843 he is said to have filed his preliminary specification of the model and plans in the United States Patent Office, and Caleb Cushing the same year sent a duplicate model to China. (See illustration in the Monitor.) The published records of the office reveal patent No. 3,673 sealed to Theodore R. Timby of Cato, N. Y., in 1844 for an improved waterwheel, also patent 4,645, 10 Nov. 1846, for its further improvement, and this is recorded as expired in 1850. On 31 Dec. 1844 a patent was granted to John Ericsson for propelling ships. But there is no record of the revolving floating or coastal battery by either inventor. It is interesting to note, however, that 11 Aug. 1841 a patent was granted to Prosper Martin of Philadelphia, Pa., for floating batteries; and 11 Oct. 1841 to Daniel Fitzgerald, New York, for submarine gunboats. Timby, from 1851 to 1861, is said to have urged the importance of the revolving floating battery on the Erie and Penobscot. Meanwhile, having developed improvements in his invention, the outbreak of the Civil War was his opportunity, and on 8 July 1862 patents Nos. 35,846 and 35,847 were granted to Theodore R. Timby of Worcester, Mass., for (a) revolving battery tower; (b) discharging guns in revolving tower by electricity, and (c) No. 36,593, 30 Sept. 1862 improved revolving battery tower. Incidentally in 1862–63 he received patents for portable warming apparatus; for mercurial barometers; for solar time globe and solar time pieces. The only record of patents to John Ericsson around these dates are three in 1863 comprising (a) instruments for taking soundings; (b) port-stopper for vessels of war; (c) operating gun carriages. Under his revolving battery tower and related patents, Timby entered into an agreement with the builders of the Monitor, including Ericsson as supervising engineer, for its use in the construction of that vessel, and received therefor $5,000. He also received $5,000 royalty for each of the two subsequent vessels built by that company. Although this American inventor received no compensation and no official recognition of his services to the country, his claims were not officially disputed. His invention of the revolving turret, as well as of the "Timby system" of coast-defense adopted by many nations, has been acknowledged by military and naval authorities at home; the legislature of New York passed (1890) a concurrent resolution declaring it to be the "duty of Congress to make such investigation as shall do ample justice to the premises and vindicate the genius that contributed so largely in rescuing the country from a grave peril during the darkest days of its existence"; and influences were brought to bear on Congress and elsewhere to secure full acknowledgment of his patent rights and remuneration for his work from the United States government. Bills to this end were introduced in the national Senate in 1893 by the senators from New York, but apparently without result. An interesting applicable commentary on such conditions may be found in the report of Charles M. Keller, examiner of patents for the year 1844 (Doc. No. 78, p. 507):
It is a matter of surprise that society at large which has been and must continue to be so much benefited by inventions and the progress of the useful arts should pay so little attention to this subject. The fruits of the labors of inventors are enjoyed and recognized by the world at large, but the authors of all these labors go unheeded with impunity, and in most cases unrewarded. It is to be regretted that literary men do not turn their attention to the progress of the useful, and, with the pen of fancy, add ornament and beauty to the solid edifice. Mr. Timby received patents for a mole and tower system of defense (1880); a subterranean system of defense (1881); and a revolving tower and shield system (1884). In his later years he was a resident of Brooklyn, N. Y., where he occupied himself with various literary and other avocations, being especially interested in scientific and philosophical pursuits. Among his writings is a volume entitled 'Lighted Lore for Gentle Folk' (1902), which contains his reflections on a variety of topics. In the 'Country and New York Herald and New York Evening Post, 7 June 1843; 'Harper's Monthly, January 1863, pp. 241–248; 'American Annual Cyclopaedia, 1864; 'Revolving Currents,' pp. 719–723; 'Toddy, or Nuts for Boys to Crack' (1866), p. 166; Parton, 'The People's Book of Biography — Lives of the Most Interesting Persons of All Ages and Countries,' containing a sketch of Timby and an account of his connection with the Monitor; King, 'Theodore R. Timby' (in Successful Americans, January 1902); America Shipbuilder, 23 Oct. 1902; 'A Half-Forgotten Hero'; and Memorial of the Patriotic League of the Revolution to the 57th Congress, presented by Virginia Chandler Titcomb, 1902.

JOHN H. CLIFFORD, C. LEONARD-STUART, Editorial Staff of The Americana.

TIME, that dimension of the world which we express in terms of before and after. Our experience of time is in general analogous with our experiences of space (q.v.), but it has certain important differences from the latter. The difference in this respect is that whereas it is customary for us to think only of the physical order of things in spatial terms, the temporal sequence pervades mind and matter alike. For this reason many philosophers who have treated of space as something secondary and derived have assigned to time a very fundamental status. This has been especially the case among such idealists as Berkeley. In Leibniz's philosophy time appears as the background, so to speak, of the pre-established harmony between the monads, while space is merely the confused conception of their logical relations. Royle, like most of the Absolute disciples of Hegel, holds a view of time which makes it prior to all finite minds, forming their natural environment, as it were, while for the Absolute Experience it is merely a phase of mental content. Bergson considers time the only true dimension of Being, when this is perceived in the truest manner by intuition, as distinct from space as an artificial intellectualization of the intuitive.

These views of the nature of time are opposed to those which assimilate it to space. Kant, for example, makes time the form of the internal sense and space the form of the external sense, and the synthetic unity of apperception always partakes of the nature of space and now partakes of this nature more than ever, for it is considered by the advocates of the theory of relativity (q.v.) that a moving body carries with it a temporal coordinate entirely different from that of the world with reference to which it is at rest and that the true units of both time and space are neither points nor moments, but moments-in-the-history-of-a-point. The grand problem in the philosophy of time consists in the harmonization of these physical theories with the apparent differences between time and space.

The first step toward the closing of this breach is the analysis of our experience of time. This has been done with great care by William James (q.v.) in his 'Principles of Psychology.' He finds that within a definite, limited interval of duration, known as the specious present, there is a direct perception of the temporal relations. After this interval has passed beyond the specious present, it can only enter into consciousness by reproductive memory. As James says, 'The object of memory is only an object imagined in the past to which the emotion of belief adheres.' One might add in the same way that our cognition of the future is only cognition by anticipation and that the object of anticipation is only an object imagined in the future to which the emotion of belief adheres.

We thus see from James' account that our temporal experience is divided into three qualitatively distinct intervals: the remembered past, the perceived specious present and the anticipated future. By means of this tripartite division, we are able to orient our present selves in the temporal stream of our own experience. However, we do not merely have at our disposal the temporal order generated by our present experience, but the memory of the temporal orders of past experiences and the expectation of the temporal orders of future experiences. These temporal orders are themselves subject to a correlation and a temporal arrangement, for two temporal orders not to be remote from each other possess in common certain items by which they may be compared and the order of their specious presents be determined. As a consequence, it is possible to construct a secondary temporal order of the immediately given temporal orders of our experience and it results directly from this that we can construct a temporal arrangement of our specious presents and their contents. We thus see how it is possible for time to have its roots in experience and yet to be a dimension in which experiences and their contents are arranged.

Now, it has been shown in the article on space that the ease with which space undergoes scientific manipulation is due to the fact that the space coordinates the spatial data of our experience which is largely determined by considerations of scientific convenience. As we have just seen, the fact that experiences are arranged in time does not prevent the stuff from time which is made from being of the nature of time. There is consequently no obstacle to a treatment of this material in a manner entirely...
TIME, MEASUREMENT OF

el to the physical treatment of space, or
and other empirical data into a single
rse which is not separable into purely
and purely temporal, all, in the use of the theory of relativity. Of course,
me of science, like the space of science,
construction which is largely arbitrary
or a sense a fiction, but there is reason
ive that the time of the unscientific man,
rgson himself, owes its homogeneity, its
definite direction of flow, its continuity,
e or less unconscious acts of construction
which differ in degree, not in nature, from
the scientist. There is no reason to
that our time data, taken raw, un-
ed, unschematized, indicate of themselves
series into which all events fit in a
er order; indeed, there is good reason to
that the laws which we unquestioningly
ate with time are outlined only in the
way in our definite temporal experi-
fore leaving the subject of the phi-
ly of time, a word or two must be con-
the Zeno and the Bergsonian paradoxes:
ave to do with the flying arrow,
cannot remain where it is, nor be
it not, and with Archiles, 
which is the swiftest of men, cannot catch up
the slow tortoise except by occupying any
of positions, and with other similar
rs. In fact, though these paradoxes seem
al with space and time, they deal with properties of infinite assemblages (see
zilages, GENERAL THEORY OF) and devise
and were in truth unanswerable until
ent thoroughgoing mathematical treat-
of these matters, though they have now
pletely solved. (For a more detailed
ent of these paradoxes see ZENO OF ELEA).
it is only necessary to state that Bergson
ently regards these difficulties as insur-
table on an intellectualistic view of time
hat James turns them to use in proving
ory that time is discontinuous.
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00 Russell, B. A. W., ‘Our Knowledge of
ternal World as a Field for Scientific
of in Philosophy’ (Chicago 1914).

ME, MEASUREMENT OF. All our meas-
of time depend primarily upon the motion
earth upon its axis and around the sun.
irst motion enables us to count off the suc-
e days; the other the successive years.
asurement of time thus becomes a most
branch of practical astronomy in
airs of men. It falls into two distinct
, other continuous, the latter to all the
e days or fractions of a day. Other units
me this may be regarded as subsidiary.
ries are determined by the count of years;
s and months by a count of days; hours,
s and seconds by dividing the day into
ons.
he primary object of a measure of time is
xpression or determination of the moment
or date of any event. This is expressed by the
period of time elapsed since some standard
moment or epoch. Long intervals, expressed in
years, are measured from some great epoch,
chased by a nation, and in Christian nations the
birth of Christ is taken for this purpose.
he general subject of measuring or expressing
ong intervals of time is treated in our article
Chronology (q.v.). The present article deals
mainly with fractions of a day, or with what
is commonly called the ‘time of day.’
To express the time of day we must have
a moment at which we consider the day to be
ning and from which we count the hours and
utes. The natural moment for this purpose
is that when the sun crosses the meridian, be-
cause it can be more easily observed than any
other phenomenon growing out of the earth’s
rotation. This moment is actually taken as
the beginning of the day by astronomers on
and, to a large extent, at sea. The latter usage grew out of the fact that
at noon the navigator determines the latitude
of his ship. But, to express the moment of an
event, navigators are now beginning to count
from midnight, as land men have always be-
the Jews formerly considered the day to begin at
sunset and the practice in ancient times was
to divide the 24 hours into two parts, the
day and the night. Each of these parts was divided into
d hours. Thus men had the first, second and
third hour of the night, etc., and the corre-
sponding hours of the day, as we see in the
Bible. Owing to the inequality in the length
of the day at different seasons of the year,
the hours thus employed were of unequal length.
In an age when the modern clock was unknown
and there was no accurate instrument for mea-
suring time in universal use, this inequality was
of little importance. But when an accurate
measure was once obtained, a more uniform
measure of the hours became necessary. For
obvious reasons midnight became the most con-
venient time to begin the day of 24 hours.
Thus arose the system of setting the clocks
at 12 when the sun crosses the meridian, be-
inning a new day 12 hours later when the
clock marks midnight and dividing the
into A.M. and P.M. This system was adopted
without change until the introduction of rail-
ways showed its defects and made a slight
modification necessary.

The first inconvenience felt from the system
arose from the fact that the intervals between
successive noons, as indicated by the passage
of the sun across the meridian, are not equal.
To show the nature and effect of the inequality,
let us suppose a perfect clock so regulated as to
go always at the same rate and to be set at noon
on 1 January of any year at the moment when
the sun crosses the meridian and to be so ex-
actly regulated as to again show noon on 1 Jan-
uary of the year following. It will be found
that, during the month of January, the clock
will continually gain by the sun at a rate of 28
seconds a day at the beginning of the month,
which rate will continually diminish to eight
seconds at the end of the month and will change
to a losing rate about the middle of February.
The effect of the accumulation will be that, at
the latter date, the clock will be found to be
more than 10 minutes ahead of noon when
the sun crosses the meridian. Then it will begin
to fall back for several months until, in May, it will have lost, minutes slower than the sun. Then it will forget itself ahead again fall behind until, when January again comes around, it will once more coincide with the sun.

This inequality between the moments of the sun's successive transits over the meridian is due to two causes, the first by the apparent diurnal motion of the stars, no inequality would be noticeable. The effect of the eccentricity is that the sun seems to move forward among the stars more rapidly in the winter months than in those of summer. And the effect of the obliquity of the ecliptic is a still larger inequality, going through its cycle of changes twice in a year.

So long as an error of modern fractions of an hour was of no importance, people in general had no occasion to trouble themselves with this inequality; but when time had to be measured to a minute, it became intolerable, and the system then had to be introduced. The latter is defined by the going of a perfect clock in the manner already supposed, and so set that, in the average of the whole year, it shall be as much ahead of the sun as behind it. The greatest difference between the clock and the sun will then be about 16 minutes, which difference occurs in one direction early in November, and in the other about the middle of February. The difference is called the equation of time and is given for each day in the house- hold almanac, thus enabling the household clock to be set by the sun. Some such system as this is now used in all civilized countries where exact time is of importance.

Besides true solar time and mean solar time, a species of time of great importance to the astronomer is sidereal time. Sidereal time is measured by the stars, or rather by the daily motion of that point in the equator from which the true right ascension of the stars is reckoned, called the vernal equinox. Dividing the space between the transits of the vernal equinox over the same meridian determine a sidereal day, which is nearly 3 minutes and 36 seconds shorter than a mean solar day, but divided, like it, into 24 hours. About 21 March and 21 September solar time follows the latter an entire day in the year. The sidereal day commences at the instant the vernal equinox makes its upper transit, and, therefore, changes in 12 months through the entire 24 hours. The hours are counted from 0 to 24.

Time may be determined by observations on the sun or stars with a sextant, or an altazimuth for rough purposes, or with a transit adjusted to the meridian, for refined work. With the last instrument a chronograph is frequently used for recording the observations. The telescope usually has from 5 to 11 equidistant lines ruled on glass (or spider lines), which are placed in the common focus of the eye piece and object glass, the centre line being adjusted to the optical axis of the telescope and set in the meridian. When ready for observations, the observer sets the telescope at the proper angle to observe the passage of the star across the meridian, and records on the chronograph the transit over each line, interpreting the transit with an observing key held in the hand and electrically connected with the chronograph, on which a break-circuit of the chronograph is made. The chronograph sheet is read by means of a scale.

A relation which was of little importance in former generations, became very important when railways were run, was that of the relation of time to sun. We readily see that, as the car revolves, the various meridians on which the train is drawn are brought into line with the sun. And of conceiving the case is to think of continually traveling around the earth from west to east. The rate of motion is one in every 15 degrees of longitude. West is true of any other hour or any such hour is about three hours behind the time coming from the Atlantic to the Pacific. The result of a passenger with a good watch to he will find his watch continuing its time at the places he reaches the opposite effect is produced when any conductor could not see their watches every minute is coming east or west, and thus every one adopt some standard of time. There were, therefore, many meridians as railroads, that frequently missed their trains out of what time to go by.

In 1883 was introduced in the United States, which is now used over the entire country, and is rapidly being made in Europe. This system consists in dividing the country into zones by meridians of 15 degrees, or one hour apart. The central meridians of the zones used in the United States and Canada are those of 60 degrees west of the meridian, 75 degrees, 90 degrees, 105 degrees, and 120 degrees, known respectively as the Atlantic, Eastern, Central Mountain, and Pacific. The line dividing one zone from the next are arranged, as nearly as a constant run about midway between these within each zone one and the other.

The result of this system is that a traveler journeys only within a zone finds the time to be everywhere the same when he crosses the line from one zone to the next, the time suddenly changes by one hour in one direction or the other. It should be carefully understood that the system of expressing time, which is throughout almost our entire country actually used is not the true length of time, as indicated by the sun, except at the standard meridians. It does not correspond to the sun's rising, as given in the standard time tables, Cincinnati, for example, is 2 1/2 hours in one direction or the other. The convenience thus arising is very great, if only one determines the passage of the sun across the line or according to his local standard meridian, in order to...
TIMGAD, ALGERIA

1 The Forum and Capitol
2 General View from the Summit of the Theatre
TIMGAD, ALGERIA

1 The Arch of Trajan

2 Mosaic Pavement in the Court of the Baths
ard time. The inconvenience thus arising is very small compared with the advantages of the uniformity to which the system gives rise. Similar systems are in use in all European countries except Ireland, Holland, Russia and Greece, which retain the time of their capitals, except in the case of the Russian railroads, which take their time from Pulkova. All other European countries take their time from meridians differing by an integral multiple of 15° or 7½° from that of Greenwich. This is in accordance with the method of reckoning time for international purposes, agreed to by the International Conference held at Washington, D. C., in 1883. Universal time is reckoned from mean noon, the day commencing at midnight, and divided into 24 (instead of into two portions of 12) hours each. Local time will still be used for local purposes; but the method of fixing it will be changed. Since the earth is divided into 360° and the day in 24 hours every 15° will represent the difference of an hour in time. If the earth be divided into 24 equal parts, at every 15th meridian, and if the local mean noon of such a meridian be designated as the standard mean time of all places 7½° each side of it, it will follow that when it is noon at Greenwich and at all places within 7½° of Greenwich, it will be 11 o'clock by local (but still noon by universal) time in places between 7½° and 22½° east of Greenwich, and 13 o'clock by local (but still noon by universal) time for all places between 7½° and 22½° east of Greenwich, and so on throughout the world. Universal time will be the same universally, and local time will differ from it only by even hours, instead of by the various odd minutes by which local standards differ from each other at the present time; while in no case will the difference between standard noon and absolute noon at any place exceed half an hour, since a difference of 7½ degrees of longitude equals a difference of half an hour in time.

Time Signals.—Many observatories send out time signals either daily, hourly or sometimes continuously every second, or every other second, to various parts of the country for the purpose of giving accurate time to all sorts of industries. They are sent out over the telegraph lines, the wires being permanently run into the observatories for the purpose, and the signals are generally sent out at the rate of 60 per minute, there being a distributing clock which is kept as near the exact time as possible. An electric current passes through the clock and is broken or closed regularly by a toothed wheel on the second hand of the clock. The best known set of time signals is that sent out by the Naval Observatory at Washington. It is as follows: three or four minutes before noon, whenever the telegraph companies switch in the loops to the observatory, the clock begins to send out make-circuit signals every second over the various lines, the minutes being indicated by leaving out the seconds 55, 56, 57, 58 and 59 in each, and the half minutes by leaving out the 29th second of each. The click following such a one-second gap then always indicates the beginning of a half-minute and the first following a gap of five seconds indicates the beginning of a minute, except at the exact noon. Just before this there is a gap of 10 seconds, and then exactly at noon the circuit closes and remains closed for just a whole second, the beginning of the marks indicating exact noon. The closing of the whole second is a form, which particular mark goes through all the telegraph lines, for this particular signal is made to do a great many things at different places, such as the dropping of time balls, and it is more important that this particular second be distinctly sent than any of the others. At the break of the noon signal the telegraph companies quickly switch out the loops to the observatory, and the lines immediately resume their normal work. In the city of Washington this particular noon signal drops a time ball on the top of the State, War and Navy Department Building, and it also automatically corrects, by setting forward or back exactly to 0 hours 0 minutes 0 seconds, all the clocks in the department. It was made by government, no matter how much they may have gained or lost since the preceding noon.

In recent years an artificial regulation of time consists in arbitrarily setting forward all public clocks by the amount of one hour on the first of May of each year, the hour being again dropped in the month of October. The principal advantage of this proceeding is that during the summer months the time of artificial lighting is lengthened, with a consequent large aggregate saving in expenditure. Up to the year 1916 this regulation had been adopted in England, Germany, France, Austria, Holland, Denmark, Norway, Italy and Portugal. It was adopted as a war measure in the United States in 1918–19, but was repealed in the latter year.

TIMGAD, Algeria, the ancient Roman city Thamugadi, in the department of Constantine, near Lambèze, about 23 miles southeast of Batna on the Philippeville-Biskra Railroad, is approached through a valley bounded by the Aures Mountains and stands on the northern fringe of the African Desert. It was a fortified frontier town at the junction of six roads, and was founded in 100 A.D. by Lucius Munatius Gallus. It flourished for three centuries and then underwent various vicissitudes, owing to native insurrections and the incursions of the Vandals, in 535 being partially destroyed. Four years later, under the Byzantine general Solomon, it was restored and had another period of prosperity until the Arab invasion of 646, when the Christian garrison of Timgad, defeated and killed, the town being subsequently abandoned, falling into ruins and gradually becoming buried beneath the desert sands. Recent excavations undertaken by the French government have revealed ruins, which are beautiful, magnificent and magnificent extent have gained for Timgad the title of the "African Pompeii." Nearly the whole of the city has been laid bare (see illustrations) and exhibits the usual Roman planning, two main streets, the Decumanus Maximus extending east and west and the Cardo Maximus intersecting at right angles, upon and around which the city was built. The principal buildings are on the main streets and among the prominent civic features are the magnificent triumphal arch of Trajan, the Forum (seating 3,500), with the theatre, basilica, library and other buildings surrounding it, the temple of Jupiter Capitolinus, statues of the Roman emperors, a Byzantine fort, the Christian basilica and ca-
TIMOLEON—TIMOR

acted by Gregory, the governor already mentioned, houses and stores, markets and annexes, thermæ and latrine. The arch of Severus and the Roman construction of its kind in northern Africa and the dominating attraction of Timгад, bears an inscription which translated reads:

"The Emperor Caesar Nerva Trajan Augustus Germanus, son of the divine Nerva, sovereign pontiff, four times tribune, three times consular, father of his country, founded the Marcan colony, Trajan of Thamugadi, by the help of the First Augustan Legion, Lucius Munatius Galba being the legal imperial proprietor."

The epigraphic wealth of the city is considerable, including inscriptions to early Christians, showing that they were persecuted and underwent martyrdom, while others bear such historical names as Novatus, a member of the Council of Carthage in 258; Sextus in 320; Faustinius, opponent of Gaudentius the Donatist, in 411, and Secundus, bishop of Numidia, exiled by Hunicus in 484. Consult Bull., A., 'Guide Illustré de Timгад' (Paris 1911).

TIMOLEON, ti'mô-lo'n, Grecian commander and liberator of Sicily; b. Corinth, about 400 to 395 B.C.; d. Syracuse, 337 B.C. He was accused of having caused the death of his brother, Timophaeus, the head of the state, and is said to have exiled himself from Corinth for 20 years in consequence. Little is known of his life until he entered the service of the Greek cities of Sicily in the effort to expel their Carthaginian invaders, an undertaking in which he met with signal success. In 343 he drove Dionysius from Syracuse and in 339, with only 12,000 men, met and conquered a force of 70,000 Carthaginians and allies under Hasdrubal and Hamilcar, at the Crimissus. Thereafter he secured the chief posts which the Carthaginians were confined to the territory east of the Halyceus. In the cities thus freed from their enemy, he restored democratic government, and was looked upon as the defender of their liberties. In Syracuse he restored ancient rights, but gave the citizens a new and yet more liberal constitution. Consult Plutarch's 'Lives.'

TIMON, ti'mon, Athenian misanthrope: b. near Athens. He flourished in the later part of the 5th century B.C., and the ingratitude of his friends so greatly embittered him that he retired into solitude. His name has become proverbial as descriptive of a misanthrope. He formed the subject of a famous dialogue by Lucian and his story is familiar through Shakespeare's tragedy.

TIMON OF ATHENS. Very little has yet been discovered concerning 'Timon of Athens.' There is no record of any early performance or any edition other than the strangely imperfect one in the folio of 1623. On the evidence of style the play is dated about 1607 and thus referred to the same period as the three other tragedies with which it has most in common, 'King Lear,' 'Antony and Cleopatra,' and 'Coriolanus.' It is generally agreed that the best parts of Timon are not only Shakespeare's but must be counted among his highest achievements in poetry,—poetry, as a recent writer has said, 'coming short of 'Lear's' path in the uncertain of dictation and certainly in pathos of situation, but surpassing even 'Lear' or 'Coriolanus' in the sheer force of that emotion which, in different forms, is common to the three plays.' (Wright). On the other hand, many of the un-Shakespearian scenes are of almost unaccountable poorness, by no means justifying Masefield's verdict that they were written by "a man of genius, a skilled writer for the stage, and of a marked personality." The best supported modern view is that something over half the play is by Shakespeare and the rest unattributable to Shakespeare of an unknown reviser. Flesy thought that the Shakespearean fragment was hastily expanded in 1623 for the express purpose of making it fill a gap in the Folio volume, caused by the decision to remove 'Troilus and Cressida' from the number of tragedies. One of the sources is certainly the brief account of Timon in Plutarch's 'Life of Mark Antony,' whence Shakespeare derived most of his material for 'Antony and Cleopatra.' This may have been supplemented by a similar, but much longer narrative in Painter's 'Palace of Pleasure.' The introduction of incidents not found in either of the foregoing works seems to establish the use also of an anonymous earlier Timon play (a comedy), and perhaps a Dialogue of Timon. There are yet unsolved difficulties about explaining how the last two writings became known to Shakespeare, for the Timon comedy seems neither to have been printed in Shakespeare's day nor acted in London, whereas Lucian's dialogue was not accessible in English. In 1678 the Restoration dramatist, Thomas Shadwell, brought out a revision of 'Timon of Athens,' of which he boasted, "I have made it into a play." The claim may be allowed, for Shadwell's play had reasonable success and there exists no positive proof that 'Timon of Athens' had ever been acted previously. A later adaptation, made by Richard Cumberland in 1768, was acted by Garrick in 1771. Cumberland omitted large portions of the original, added the character of Evanthe, Timon's daughter, romanticized that of her lover, Alcibiades, and much lightened the gloom of the play's close. This piece was a failure. Horace Walpole remarked sarcastically that Cumberland's alteration was "wantonly well done, for he has caught the manner and diction of the original so exactly, that I think it is full as bad a play as it was before he corrected it." The best recent discussion of 'Timon of Athens' is by E. H. Wright. ('The Authorship of Timon of Athens,' 1910).

TUCKER BROOK

TIMOR, ti'môr, an island of the Malay Archipelago, the most eastern and largest of the Lesser Sunda Islands, 700 miles southeast of Borneo and 500 miles west by south of Papua or New Guinea; length, 300 miles; width, 60 miles; area, 12,450 square miles. Coasts are steep and generally difficult of access as an account of coral reefs; the island is traversed by a mountain chain everywhere giving evidence of volcanic action; highest point, Mount Atlas, over 12,000 feet; the interior is very little known. The vegetation is less luxuriant and less varied than in the other islands of the East Indies. The coast lands are cultivated to some extent, the northern part of the island being more favorable to agriculture than the southern.

Coffee, rice, sugar and cacao are grown, but mostly for domestic use; some sago is exported, also sandalwood, wax, trepang and
shell. Horses, ponies and cattle are a few exported. There is considerable wealth, but it has not been described. The people are mainly Papuan, with Polynesian and Negrito mixture, with Chinese, who control the trade. Many ople are savage, being classed as head. The island politically is divided between Portugal and Holland, the northern part being Portuguese and the southern part (3,120 square miles) Dutch. Dutch mission was first made by treaty in 1859, boundaries and relationship of the two more exactly defined by another treaty. In 1908 another treaty was ratified and territory exchanged between these states. The Dutch capital is Kupang (pop.), the Portuguese Dili (3,000 pop.), a group of islands of the Malay Peninsula, lying about 300 miles east by north of the island and 150 miles west by south of India, all being southwest of New Britain. The island consists of Yamdena (or Yt), 1,151 square miles in area, Selaru, or dat, Molu and Maro and a number of uninhabited islands, with a total area 2,000 square miles. The larger islands the maximum elevation being 820 feet; 200 are low and flat, of coral formation. are is carried on in a primitive fashion; cattle are raised; turtle fishing is an important, and turtle and are exported. The population is estimated at 20,000, mostly Papuans.

ORTHEUS, Athenian general: b. about the 5th century; d. Chalce in Euboea, 432 B.C. In 378 he was made commander in chief of the Athenian fleet sent out by the Athenian Confederacy to the Peloponnesian coast along the coast of Lacedaemon and of the Spartan fleet in 375. Peace was declared with Sparta, he was recalled to Athens. In 372, having been sent to the island of Samos, and by her acquisition of Sestus and Cratho, the control of the Hellespont was appointed, with Chares the command of an expedition Byzantium, but refusing to engage in a what he deemed an unpromising mission, was accused by Chares of causing the 1 against, and was deposed from power. ORTHUS, ti-mo'the-us, Greek dithyramb poet: d. 357 B.C. He was the most lyric poet of his day. An ancient Greek system of about 100 lines of his 'Nomoi,' said at Abydus, in Egypt, in 1902, is believed to be the oldest Greek writing in existence and is thought to have been copied in the 5th century B.C. It is in the Attic poetic style, originality in metre and the defeat of the Persians at Salamis. He was also renowned in his time, his instrument, the cithara, and his knowledge of harmonic principles. A number of the fragments of his poems are to be found in Bergk's 'Poetae Lyrici Graeci.' Consult also Smyth, H. W., 'Greek Melic Poets' (New York 1900); Wright, W. C., 'Short History of Greek Literature' (New York 1907).

TIMOTHY, a disciple of Saint Paul: b. in Lycaonia, Asia Minor, probably at Lystra, of a Gentile father and Jewish mother. His father's name is unknown; his mother's name is Eunice, his grandmother's Lois. By his mother and grandmother he was early made familiar with the Old Testament Scriptures, and it seems likely that by them also he was first instructed in the Christian faith, which they had probably been won over to on Saint Paul's first missionary visit to Lystra, while Timothy was still very young. When Saint Paul, along with Silas, visited Lystra on his second missionary journey, seven years after the first, Timothy became an active fellow-worker with the apostle, and he accompanied him and Silas in the further course of their mission. Timothy accompanied Paul to Philippi and Berea; but he is not mentioned as being with Paul at Thessalonica, which the apostle visited after Philippi and before Berea. He was then left in the last mentioned city alone, but rejoined Paul at Athens, from which he was sent back to Thessalonica. After remaining there some time he once more joined his master at Corinth. No further mention is made of Timothy till at least five years later, when he is found with Paul at Ephesus on his third missionary journey. Timothy lived along with Erastus into Macedonia and Achaia to prepare the churches in that city for the visit that Paul himself was meditating (Acts xix, 22). Timothy met the apostle again in Macedonia, and was among those who preceded him on his journey to Jerusalem. We lose sight of him for the next two or three years; but he appears at Rome with Paul at the time when the epistles to the Colossians, Philemon and Philemon were written. From the third verse of the first chapter of the first epistle to Timothy we learn that Timothy was on one occasion left at Ephesus when Paul went into Macedonia, and it is supposed that this was after Paul had been released from the confinement in which he was placed when he was sent to Rome from Jerusalem. Tradition makes Timothy the first bishop of Ephesus. He is said to have been martyred in the reign of Domitian or Nerva.

TIMOTHY AND TITUS, Epistles to Pastoral Epistles. The two letters which purport to have been written by the Apostle Paul to his young friend and assistant Timothy and the letter which in the same way purports to have been written to his fellow-worker Titus are commonly called from the nature of their contents the 'Pastoral Epistles.' They sustain so many resemblances to each other that it is simplest and most helpful to treat them as a group, as, indeed, is commonly done.

Arguments as to Paul's Authorship. Before touching on their contents and significance, it is best to take up the much debated problem of their authorship. External evidence in favor of Paul's having written them, consisting of quotations and citations by name, is abundant from the earliest times. It is pointed out, in fact, to Polycarp and Ignatius (before 120), if not to Clement of Rome (95). The one case of rejection, that by Marcion, is plausibly ex-
plained on the ground of antagonism to the doctrines taught. The strong attestation gained them to any considerable ascendency as from Paul down to about the beginning of the last century, but since that time scarcely any point in New Testament criticism has been more constantly and strenuously disputed, and at present there is no point on which critics who deserve consideration are more evenly divided.

(1) The first objection to be noted is that these letters cannot be from Paul's pen because the circumstances implied do not agree with the conditions otherwise known to have existed at any time in the apostle's life. It is admitted on all sides that there is no period described in Acts into which these letters fit, but the latest criticism, under the influence of Harnack, holds that Acts was written before the end of Paul's imprisonment at Rome and, if so, it is as legitimate to hold that he was released as that he was put to death soon after the time reached in the story of Acts. This release is rendered plausible by the facts that there was no charge against him on which he could have been fairly condemned (cf. Acts xxvi, 32); that Paul certainly not only hoped but expected release (Phil. i. 22; Philmon 22); and that he was there when John wrote at Ephesus where exists on the subject is to the effect that he visited Spain as he earlier intended, which would imply release from his first imprisonment. The question of the genuineness of these letters must be considered apart, as this is a question which Pauline authorship is that the vocabulary, the formation of the sentences and the way in which they are related to each other vary irreconcilably from Paul's acknowledged writings. A difference on these points must certainly be recognized, but when we consider the difference in the topics discussed, the lapse of time, which, if not more than five years since the composition of Philippians, might have brought many new circumstances to influence language, and the possible freedom with which Paul's amanuensis may have reproduced what he gave out, it is held by many critics of acuteness and standing that the difference may be harmonized with Pauline authorship. It is true that it has lately been urged that the language and style of the "Pastoral" approach in many points those of Luke and that, as it is said in 2 Timothy that he was Paul's only companion when that letter was written, it is presumable that he put that letter on paper, and if so, almost certainly the other two, a fact which would go far to explain the differences under consideration. It is also to be taken into account that the peculiarities of vocabulary and style are equally, if not more difficult, to explain on the theory that the letters were fabricated in direct imitation of Paul's genuine letters, since such a literary artist would naturally have avoided such striking deviations from Paul's previous usage as are recognized to exist. (3) It is also urged that the doctrinal content of these Epistles is inconsistent with Paul's teaching in other letters, and it should be noted at least in the form of presentation of truth actually exists. But when it is taken into account that the opponents of Pauline authorship commonly hold that these letters were written by a "Paulinist," probably by a disciple who felt that he was merely reproducing his master's ideas, it must also be recognized that no doctrinal contradiction or essential consistency exists between the two sets of teaching. When the variations in presentation of his theological views in the Epistles, as in 1 Corinthians, Romans, and Colossians, are taken into account, it should equally be recognized that in the circumstances presupposed in these Paul might have given the which stands in them. (4) It is also sometimes alleged that the conditions which are implied as existing in the churches, alike as to heresies as to church government, require a later date than can fall in the lifetime of Paul. But answered that the government of the is as by no means so advanced as is asserted, and that there is no ground for supposing that this stage of ecclesiastical development and also such a prevalence of error as is alleged, might have been reached by the year (5) It is also objected that the tone of these letters is more formal and distant than that of the other Epistles, as though these letters were the letters of one in a church; that direction is given to the Ephesians, that on the ground, as is implied in 1 Timothy, when he urges his leaving his work diately, as in 2 Timothy, by which it is ceivable that Paul should have addressed himself to Timothy as a young man, it is argued that the letters, especially 1 and Titus, were in reality "open letters," intended to be read to the churches at hand and Crete; that 1 Timothy and Titus imply that Paul had himself been in Ephesus, that as Timothy might be uncer, delayed in leaving at Paul's request, might well be given to apply in case of hindrance; that it is not unnatural that a man who years before had called him "aged," should still think of Timothy as being a not uncommon characteristic of an elderly man, and that Paul might consider in the next generation more youthful than they were, and that it is by no means unreasonable to hold that Timothy was not only strengthening and heartening of the apostles, these letters, as Paul the strong may have been especially drawn to him by traits which would show as weakness, had to live his own independent life as a leader. It is also to be noted that every one of these points tells as well against the supposition of fabrication, as fabricator would naturally avoid these qualities, and, in particular, would not be able to account for anything which might seem to discreditably upon Timothy.

Critical Conclusion.—So far as contentions are concerned, it may be held that neither side has advanced arguments, but that, while the characteristic letters does not demonstrate Paul's author on the other hand, the letters have not been proved to be by another hand. Perhaps the main criticisms do not accept Pauline authorship for as they now stand find themselves to recognize that many of the historical especially in 2 Timothy, are genuinely historical. Various attempts have been made to s
TIMOTHY — TIMUR

fragments could have been woven into the others otherwise fabricated, but thus far all explanations of such parallels appear to have been futile. It is impossible to determine from any of the literary phenomenon that the work of the Muratorian Fragment was written by St. Timothy, written out of personal interest and regard, and still held in high esteem by the Catholic Church in the arrangement of ecclesiastical discipline.

Occasion and Order of Epistles.—If not the work of St. Timothy, written out of personal interest and regard, and still held in high esteem by the Catholic Church in the arrangement of ecclesiastical discipline.

TIMOQUOMAN FAMILY, a group of American Indians formerly occupying central and northern Florida. In 1527 — when first known to the Spaniards — these Indians had some 50 settlements along the Saint John's River. There were five original tribes speaking as many dialects. Wars of extermination and the inroads of the English from Carolina gradually reduced the tribes in numbers, and they fled to Volusia County, at the headwater of the Saint John's. The territory thus abandoned was afterward occupied by the Seminoles (q.v.).

TIMUR, té-moor, TIMUR BEG, TIMUR LENG, TAMERLANE, the latter a corruption of Timur Leng, "Timur the Lame"). Mongol conqueror: b. Kesh, near Samarcand, about 1336; d. Otrar, 17 Feb. 1405. He was a descendant of Genghis Khan and became chief of his tribe in 1370, having previously reigned jointly for some years with his brother-in-law, Hussain, of whom he became jealous and whom he put to death, after defeating him in a short civil war. He established a firm government in his dominions and then embarked on his career of conquest. He subdued Persia and the whole of central Asia from the Great Wall of China to Moscow, and in 1398 invaded India, which he mastered from the Indus to the mouth of the Ganges. His cruelty knew no bounds. On one occasion, it is recorded, he massacred 100,000 prisoners, while on the banks of the Ganges he was called by the emperor of the East and other princes to aid in repelling the Turks under Bajazet. He wrested Syria from the Mamelukes on his return journey, overran the sultan's dominions with his vast army and on 20 June 1402 met Bajazet on the plain of Angora, routed his immense army and took him prisoner. In 1404 he began preparations for an expedition into China, and early in 1405 began the advance which was stopped by his death. Timur, however, was not a mere barbarian. He was an able administrator, with many statesmanlike traits, a patron of science and art and is also reputed to have been an author, though on dubious evidence. Consult Howorth, "History of the Mongols"; Jean de Bec, "Tambur-
Tin, a white, ductile metal, obtained by smelting tin-stone or cassiterite—so-called from the Cassiterides, islands from which it was first brought into European markets. Tin appears to have been known in the time of Moses; and at a somewhat later period in Jewish history, iron and brass were brought by the ships of Tarshish from the islands east of the Persian Gulf. The Phoenicians traded largely in the tin ores of Cornwall, which was then, as now, celebrated for its mineral wealth. The mountains which separate Galicia from Portugal were also very productive of tin in ancient times, and still continue unexhausted. The mountains between Saxony and Bohemia have been wrought as tin mines for several centuries and still continue productive. Mines of it occur in the Peninsula of Malacca, in India, in Chile, in Mexico, in Peru, etc. Large deposits of tin-stone have been discovered in Queensland, New South Wales and Tasmania.

Tin-stone or tin dioxide (SnO₂) is the only ore used for obtaining metallic tin. Its chemical composition is oxygen 21.4 per cent, tin 78.6 per cent. It is found disseminated throughout the alluvium of valleys or in lode at considerable depths beneath the surface; the former deposits yield what is called stream-tin, while from the latter mine-tin is obtained. The first process to which the ore is subjected is grinding. The ground ore is then washed, which removes the impurities; for the specific gravity is so high that it is easy to wash away the earthy matter, and even some of the foreign metallic ores with which it is often mingled. But there are other bodies so nearly of the same specific gravity of the tin ore that they cannot be thus removed. The ore is then roasted in a reverberatory furnace, whereby most of the sulphur and arsenic are expelled. The ore, thus freed as much as possible from foreign matter, is mixed with from 15 to 20 per cent of its weight of pulverized antracite coal and a small portion of flux, generally lime-stone, and heated strongly in a reverberatory furnace, so as to bring the whole into the state of fusion which is kept up with gradually increasing temperature for about eight hours. The lime unites with the earthy matters still mixed with the ore and flows with them into a liquid slag, while the coal reduces the oxide of tin to the metallic state. The reduced tin falls by its own weight to the bottom, and is, at the end of about eight hours, let out by tapping a hole in the furnace which had been filled with clay.

Refining Process.—The tin thus obtained is still very impure; it contains generally iron, copper, arsenic and fume-sten. In order to purify it the blocks of tin are placed in a reverberatory furnace and moderately heated to the point where the tin melts and flows into the refining basins, while the greater part of the foreign metals remains in the solid state. The molten tin flows slowly stirred with poles of green wood, whence gases are given off, and the metal is maintained in a state of artificial ebullition. The upper parts of the contents of the basin are oxidized and removed from the surface, while the greater part of the foreign metals collects at the bottom. The metal is allowed to partially cool, during which process it separates into zones, the upper consisting of nearly pure tin, while the impure that it must be returned to the furnace and again melted. The upper layer is removed into molds, containing each a three hundredweight, in which it is allowed to solidify; it is then sent into the market as tin, the purest specimens being called raw.

Characteristics.—Tin, when pure, is a fine white color like silver but with a bluish hue, and when newly melted its b has a great. It has a slightly disagreeable and emits a peculiar smell when rubbed. Hardness is between that of gold and of Specific gravity, 7.28. It is very malleable leaf, or tin-foil as it is called, is about one-thousandth part of an inch thick, it might be beaten out into sheets thin again, if such were wanted for purposes of art. Its ductility and lity are much inferior to those of most metals known in early times; a bar of quarter of an inch in diameter will not a greater weight than 254 pounds. Tin is flexible and produces, while bending, a able cracking noise, known as the "cry" it melts at about 460° F. When cooled it may be obtained crystallized in the form of rhombic prism. By washing the surf of mass of tin with warm dilute aqua becomes covered with a number of which, from their unequal action upon give an appearance to the metal somen resembling that of watered silk. After a exposure to the air tin loses its lustre becomes covered with a grayish-black color, but under further alteration. Neither is it sensib to being kept under water. When co 54° below zero it undergoes a to what it is called "gray tin." It is it is very brittle and has lost its properties. When tin is melted in an sel its surface becomes very soon covered a gray powder, which is an oxide of t If the heat be continued the color of y gradually changes, and at last bec

Tin Ores.—These are but two tin ore and tin pyrites, known respectively the technical names of cassiterite and oxide. The first of these occurs crystallized in great variety of forms, which erived from an octahedron with a angle over the apex being 112° the majority of the crystals have, one of a right square prism, with nun mids at each extremity. They occur in twin form, the twin crystals for. The cleavages take place parallel to the face of this prism and with both its di sides of the above-named octahedra. The difficulty. The prisms are sometimes c streaked. Lustre adamantine; color shades of white, gray, yellow, red, or black; streak pale gray, in some somet transparent, and in others opaque; bri ness six to seven, about that of for gravity, 6.96. Tin ore presents it variety of compound or matted cry occurs reniform, rarely in botryoid, and massive, with a granular c.
the individuals being strongly and the fracture uneven. The wood-
Cornish mines is a mere variety of is so-called because of its resem-
cross section of the trunk of a tree, bination, also in beds and veins, in
acentric rings of annual growth. In It also occurs in the beds and al-
lark reddish to brown. The follow-
sits of streams in the form of rolled ins were found in specimens of
...ect wood-tin ore:

<table>
<thead>
<tr>
<th>Crystallized</th>
<th>Massive</th>
<th>Wood-tin</th>
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<tbody>
<tr>
<td>99.00</td>
<td>95.00</td>
<td>85.14</td>
</tr>
<tr>
<td>0.25</td>
<td>5.00</td>
<td>13.42</td>
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<tr>
<td>0.75</td>
<td>0.00</td>
<td>1.03</td>
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test purity cassiterite contains nothing of tin. Alone it does not melt blowpipe, but is reducible when in
pharmacists and dwellings. y called wood-tin has hitherto been in these repositories, but is occasion-
in pockets in rock formations. Tin H5.5Fe:SnS), the other ore of tin, assive, with a granular composition; it is imperfectly conchoidal; lustre
steel-gray, inclining to yellow; k; opaque; brittle; hardness about or-spars; specific gravity, 4.35. Be-
pipe sulphur is driven off and the tins into a blackish scoria, without metallic luster. It is soluble in
acid, with precipitation of part hurs. It contains from 14 to 30 per
It is found at Saint Agnes in Corn-
OUNT.—The world's production of alendar year 1916 amounted to 135,-
tons. Of this total, 49,130 tons per cent came from the Peruvian for-
s; 23,500 tons from Bolivia; 14,-
Banca, Dutch East Indies; 9,400
Siarn; 8,400 tons from China; 5,960
Australia; 5,680 tons from Nigeria;
Billiton and Singkpe, Dutch
s; 5,260 tons from Cornwall, Eng-
ons from the British Protected
ns; 2,100 tons from the Union of
ia; and 1,500 tons from all other
All told, 33,000 tons were lode tin—
South Africa and
and the remainder from placer.
The total is 10,870 tons less than ust preceding the war. Incomplete data shows that the output for 1917 is 17,869 tons more than for 1916, in spite
4,600 tons produced in the United States, has increased to 4,600,000 tons in of Bolivia. Although the complete statistics of the gold and silver production for 1917, amounting to 21,000,000 annually, the market, the price of tin rose during 1917—from 44.19 cents per pound in
these figures are to be compared
with an average price of about 44 cents per pound for the years immediately preceding the war. During the first years of the conflict the price fell below 31 cents.

The contribution of the United States to the 1916 total was about 140 short tons, derived almost entirely from Alaska, and chiefly the product of dredges operating in the York district, in the eastern part of the Seward Peninsula. The output of this district was 162 tons of "stream tin" estimated to average 60 per cent of metallic tin. Nearly two-thirds of the whole Alaskan output was sent to Singapore to be smelted and refined. The United States output for 1917 was but 90 tons. Nearly all of the production is from placer workings, the one lode mine worked being the Lost River mine, in Alaska. The other tin producing localities in the United States are in Lander and Humboldt counties, Nevada; the Black Hills in Pennington County, South Dakota; near Lincoln on in North Carolina; near Gaffney, South Carolina; and in the Franklin Mountains, north of El Paso, Texas. In all of these localities the ore is cassiterite. This ore has been found in small quantities also in the Te
coe, Mountain of California, near Corona—a deposit which produced 135 tons of tin in 1890–91; in Virginia, in Rockbridge and Nelson counties; in Washington, at Silver Hill, near Spokane; in Maine, at Winslow, and several other localities; and in New Hampshire, at Jackson. Wood-tin has been found in the gravel bearing gravel of Panther Creek, Idaho; and in the Big Prickly Pear Creek district of Montana. There was in 1916 but one smelter in the United States handling tin ores, the plant of the American Smelting and Refining Com-
pamy at Perth Amboy, N. J. Its capacity is about 14,000 tons of tin per year and it works almost solely upon Bolivian concentrates. Before the war a large percentage of the Bolivian tin concentrates was sent to Germany for smelt-
ing. With the cessation of this service a large smelting plant was built in Chile and another plant erected in the United States.

In 1917 there was imported into the United States for consumption a total of 77,866 short tons of metallic tin, having an aggregate value of $68,603,439. Thus it appears that the United States consumed nearly 57 per cent of the entire world's output of tin for the year.

Bowditch.—Charlestone, A. G., "Tin: Chief Methods of Mining, Dressing and Smelting" (1884); Fawcett, S., "Tin Deposits of the World" (1905); Hess, F. L., and E., "Bibliography of the Geology and Mineral Resources of the United States" (Washington 1912); Neumann, B., "Die Metalle" (1904); Ressing, A., "Geschichte der Metalle" (1901). For general statistics and industrial information consult "The Mineral Industry" (annually, New York).
TIN HORN WAR. See United States, the Wars of the.

TIN MOUTH, a fish. See Crappie.

TIN PLATE, Manufacture of. The manufacture of tin plate was probably begun in Bohemia, about the beginning of the 16th century, and was first attempted in England about 1670. The early crude methods consisted of the simple process of dipping the plates of iron in a vat of molten tin and allowing the surplus metal to drain off. In 1865 Mr. Morewood, of South Wales, England, invented a machine which gave tin plate manufacture its start, greatly reducing the cost of production. At the surface of the pot he placed a pair of steel rods which seized the plate as it came up and rolled off the superfluous tin; thus leaving the coating of the plate smooth and even. Since then many improvements have been made in the methods of manufacture, making the product more serviceable and reducing materially the manufacturing expenses. The modern method is as follows:

After the bars of steel have reached the rolling mill they are first cut into accurate lengths, then placed in the sheet-mill furnace, brought to a cherry-red heat, taken out in pairs and given three or four passes through roughing rolls, each bar being fed through sidewise and rolled singly. After cooling they are again heated, placed one upon the other, and in pairs are again rolled. The doubler then grasps the plates at one end with a pair of large tongs and brings the two ends together. The loose ends are then sorn off square, and the fold is flattened by means of a powerful press, thus making four thicknesses or plates, one end of each being free, the other still forming the bend. The plates are again heated, passed through the roughing rolls, taken by the doubler, opened back to the bend, and once more doubled. The first bend is nipped off when the ends are squared, thus making one free end for each sheet in the pack. This is done to prevent buckling and to insure a perfect finished plate. They are then passed through the fourth time, passed two or three times more through the finishing rolls and are then ready for the picker.

After the sheets have been separated and examined for possible flaws, they are sent to the black picker, where they are immersed in a strong solution of acid and hot water to remove all dirt, after which they are rinsed and allowed to drain. All perfect plates, in order to make them sufficiently soft for general use, are sent to the annealing furnace, which softens the pores and toughens the plate. After being heated there thoroughly for a period of about 12 hours the plates are cooled off and carried to the cold rolls through which they are passed. The resquarer then trims the four edges and re-stacks the plates in the annealing box; they are again annealed and put into the white picker, in which the acid solution is much weaker than in the first bath.

Having been pickled and washed, the plates are placed in water baths; immersed in a bath of melted palm-oil; placed in a pot containing molten tin and lead; and finally dipped into another pot of tin of lower temperature than the previous one. From the tumming pot they are put into the prease pot, the thickness of the coating being determined by the time they remain therein. After which they are cleaned by passing through bran dust. This completes the process and the plates are ready for the market.

According to the census of 1905 there were in the United States 36 establishments in the manufacture of tin plate, $10,813,239 capital and 4,847 persons, wages $2,383,070 for wages and $31,375,714 for material; and having an aggregate output of 35,283,360. The business has increased since, and the present method of forming the production is by boxes. Of the production in 1914 was 20,271,683, 1915 22,437, 1916 26,979,994 and 1917 32,898,597. A tremendous increase, due to war orders, but not maintained unless there is an increase in the production of tin, which is not expected.


TIN WEDDING. See Wedding Versaries.

TINAMOU, a South American bird, the Cryptornis, called "partridge" by South American colonists because of its superficial lilac color. These birds, but structurally occupying a distinct place, the determination of which is one of the tasks of greatly puzzled ornithologists. The view is generally held that they are a very ancient form of birds, which though not to be removed from the Carinata present so much resemblance the Rallidae as to indicate them to be the nearest allies of these birds. Many genera and species are known which are found in South America and two or three forms are found in the northward into Mexico. They vary in size from that of a quail to a guinea hen. Their head is small, neck slender, bill elongated, and plumage close and inconspicuous, usually darkish or bluish, with few ornamental markings. The wings are short and rounded, and the tail short and soft as in some species to absent altogether. Some of them inhabit forest and others more open country, and show little skill or courage in escaping capture. Their flesh is delicious, resembling that of a chicken. They are not common, being eggs, since the shell "looks as if it were lightly burnished metal or glazed porcelaln." This is also true of the many rattle characters of this curious group of birds. Cottrell, "Dictionary of Birds" (New York, 1899) will be found many references to this species.

TINCAL, or TINKAL, a com name for borax (q.v.) in the crude form.

TINCKER, Mary Agnes, American writer. b. Ellsworth, Me., 18 July 1833. Earlier days she spent in a parochial school and from 1873 to 1876 in Italy. Her best known novel is 'Aldin's Niece' (1878); others are 'Tiber' (1881); 'The Jewel in the (1884); 'Aurora' (1885); 'Autumn' (1889).
TINCTURE, in pharmacy, an alcoholic of some medicinal substance, prepared tion, maceration or percolation. It may solution of some chemical element as of some single chemical compound as of iron, or a solution of that part of any oil which will dissolve in the solvent sample, tincture of cinchona bark. Sim- ures are those obtained from a single compound tinctures from many. The (menstrua) are various; pure alcohol, of alcohol and water or of alcohol ric, alcoholic solutions containing am- ete.

DAL, Matthew, English controversial- leer Ferris, in Devonshire, about 1653; Aug. 1733. He was graduated from College, Oxford, in 1653; in 1678 was a Fellow of All Souls' College, and became a Doctor of Civil Law, and of Doctor's Commons. In the James II he turned Roman Catholic, and returned to the Church of England. ished several pieces, political and theo- am, which were, 'A Letter to the men of the two Universities, on the sub- he Trinity and Athanasian Creed,' and c, 'The Rights of the Christian Church againstPriests' (1706). This work a sensation among the high church who attacked it with great vigor. Tindal d two defenses of it, which the House nones ordered to be burned by the comm- man, with the original treatise. In published his 'Christianity as Old as tion, or the Gospel a Republication of the of Nature,' in which his object was that there cannot be any revelation from the internal revelation of the law e in the hearts of mankind. This de- rationalist work — by which his name y known — received a great many

DALL, or TYNDALE, William, Eng- er and translator of the Bible: b.ish borders, about 1490; d. Vilvoorden, Aug. 1536. He entered the Univers- 1510, and was graduated in 1518 subsequently went to Cambridge, resided till 1521, and about this latter ame tutor to the children of Sir John a landed gentleman in Gloucestershire. ched with great acceptance in the neigh- but soon got into trouble owing to his b views. In 1523 he went to London, came under the influence of Luther's It was at this time that he began his translation of the New Testament, but had safe to carry out such a work in Eng- went to Hamburg in 1524, and imme- erward to Luther at Wittenberg, where ined till April 1525. During this time cceeding with his translation, with the c of old William Roy, and the printing s begun at Cologne in 1525. A Roman clergyman, John Cochlaus, came to this, and obtained an injunction order- stoppage of the work, whereupon Tint- tions and had the work printed he was smuggled into England in 1526, once Archbishop Warham and Bishop took the lead in seizing and burning Attempts were also made to get hold of Tindall, but he fled to Marburg, where he enjoyed the protection of the landgrave of Hesse. Here he became a Zwinglian in his attitude on the Eucharist, and published some of his most important original works, including 'The Parable of the Wicked Mammon' (1528); 'The Obedience of a Christian Man' and 'How Christian Rulers Ought to Govern' (1529), and 'The Pratyche of Prelates' (1530). He also engaged in a vigorous polemic with Sir Thomas More. From Marburg he went to the Netherlands, and for several years resided in Antwerp, but toward 1533 left the city for a time, owing to Henry VIII's efforts to seize him. In 1535 he was captured at Antwerp by the imperial officers, assisted by an English Roman Catholic student named Phillips who promised to adopt his reforming opinions. He was lodged in the state prison at Vilvoorden, near Brussels, and despite some efforts to save him, made by Cromwell and others, he was tried for heresy, condemned, degraded from holy orders, then strangled and his body burned. A fragment of the interrupted Cologne print of his New Testament translation is in the British Museum, and there are two extant copies of the first edition of his complete New Testa- 1525), one (practically complete) at Baptist College, Bristol, the other (incomplete) in Saint Paul's Cathedral. A revised edition was issued by him at Antwerp in 1534, and a further revision in the following year. His translation of the Pentateuch appeared at Mar- burg in 1529-30, and that of Jonah at Antwerp in 1531; a copy of each is in the British Mu- seum. Tindall's translation is of much importance in the history of the English style and English literature, and formed the basis, as far as it went, of the Authorized Version of nearly a century later. There is an edition of Tindall's original works by the Parker Society (3 vols., 1848-50). Consult Deems, 'Life of William Tindall' (1886); Price, I. M., 'Ancestry of Our English Bible' (Phila. 1907).

TINDER, a dry substance that readily ignites from a spark; before the introduction of friction matches, it was in common use as a means of starting a fire. It consisted usually of charred linen which caught the spark from a flint and steel; since the tinder did not flame, the fire was started by touching a match dipped in sulphur to the ignited tinder. Tinder-boxes were boxes in which tinder was kept ready for use; they were usually provided with a flint and steel, the latter often fastened to the cover of the box in such a manner that the flint when struck against it sent sparks into the tinder within. German tinder* or amadou consisted of the more solid portions of certain fungi, mainly tree-growing polyopes, prepared by boiling in water and drying. Sometimes saltpetre, or even a little gunpowder, was added. Amadou has been used to stop bleeding and also in surgery as a support and for pressure and protection. Spanish tinder* was a stuff prepared from the pubescence of the flowerheads, stems and leaves of globe thistles. The use of the word tinder has been extended to denote any substance easily inflammable.

TINEIDÆ, a family of moths, prominently represented by several small species whose caterpillars are destructive to woolen fabrics, furs and various stored products. See CLOTHES-
TILEY, Katherine, American theosophist: b. Newburyport, Mass., 6 July 1852. She married P. B. Tingley in 1889. She was for some years an assistant to W. Q. Judge, who with H. P. Blavatsky were active in establishing theosophy as a philosophy and religion and on his death she founded, 18 Feb. 1898, a new branch called the Universal Brotherhood and Theosophical Society, which has branches in many cities and countries and headquarters at Point Loma, Cal. She has edited Century Path for a number of years and has written ‘The Mysteries of the Heart Doctrine’ (1902); ‘Nosegay of Everlastings’ (1913); ‘Theosophy and Some of the Vital Problems of the Day’ (1915). See Theosophy.

TINOCERAS, ti-nōs-e-ras, a genus of mammals now extinct, found in the Eocene of Wyoming (Bridge beds) and representing the order Dinocerata. The individuals were all large, some of them nearly equaling the elephants and differing little from, if, indeed, they were not identical with, Uintatherium.

TINOS, tēnōs, or TENOS, tēnōs, Greece. An island in the monarchy of the Cyclades, immediately south of Andros. It is 18 miles long by eight miles broad and has an area of 81 square miles. It is traversed by high mountains, the terraced slopes of which yield wine, wheat, mohns, figs. Marble and silk goods are the chief exports. Tenos or Hagios Nikolas, the chief town, on the south coast, is the see of a Roman Catholic bishop, has two Roman Catholic churches and a small harbor. North of the town is the white marble church of Penagia Evangelistria, a famous pilgrim resort. Excavations in 1902 on the site of ancient Tenos revealed remains of the temple of Poseidon. Tenos was prominent in the wars with the Persians and during the Greek Revolution 1821–27. Pop. 12,000.

TINTERN ABBEY, England, a ruin of unrivaled beauty in Monmouthshire, on the Wye, eight miles south of Monmouth. It was founded in 1131 by the Cistercian monks—the church in 1287. It was once the most important of the Augustinian houses and served as the source of the translation from Early English to the Decorated. The open work of the windows is one of its chief beauties. Under Henry VIII the abbey was dismantled and its lands bestowed upon the earl of Worcester.

TINTERN ABBEY. ’Lines Composed a Few Miles above Tintern Abbey, on Revisiting the Banks of the Wye during a Tour, July 13, 1798’ a reflective poem in 159 lines of blank verse, by William Wordsworth, was composed in 1798, and was published that same year in the foregoing volume entitled ‘Lyrical Ballads.’ The clumsy title has long since been shortened by the public to ‘Tintern Abbey’—in itself misleading, since the poem has nothing to do with the abbey, which is used simply to identify the landscape that serves as a basis for the poet’s reflections. Wordsworth had visited the region alone and on foot in 1793; upon his second visit, five years later, he recalls the first and compares his feeling for nature at that time with what it is now. His theme in general is the inter-relation between nature and the spirit of man, each as an interpreter and revealer of the other: the contemplation of nature gives an insight into the invisible world that comprehends both nature and man; nature has the power to enlighten the mystery of human life; the consciousness and sustain; man’s own emotional experiences, in turn, reveal to him both thought and style are Wordsworth’s great poems; each complements the other; taken together they form the locus classicus of the Wordsworthian faith and doctrine. Platonism that informs the Ode, less fundamental to ‘Tintern Abbey,’ yet the latter throughout.

The poet distinguishes three periods in his attitude toward nature: his boyhood, merely animal delight, grows into a rousing appreciation of natural beauty, and in turn finally develops into a moral and contemplative attitude and brings the “philosophical mind” that identifies nature, man and God (compare ‘The Prelude,’ Book VIII, 340–356). Perhaps none of the ideas in the poem, taken singly, was new to the world; certainly never before had they been fused into a whole and stated with such impressive and splendid as the utterance of one great personality. The style of the poem, though, is a perfect expression of his own, and the theme is Wordsworth’s “grand manner,” as in ‘Ode,’ no less appropriate and perfect a way than the beautiful simplicity of his ‘chapel’ (q.v.). No other of his poems contains so many of his most felicitous lines, such as ‘the still, sad music of humanity’; ‘the little, nameless, unremembered acts of kindness and of love’; ‘nature never did betray the heart that loved her.’

Its faith in the entire beneficence of man is of course the obvious weakness of the poem considered philosophically. How far 19th century theories of human nature, which cannot be discussed here, must have affected Wordsworth’s failure to see other side of nature, by his lack of vision. Here he speaks simply as a seer, the passage in which he declares his sense of God’s love which the shining words of suns is perhaps as moving and sublime as in the whole range of English poetry, as incomparable, at least in style, as anything in Shakespeare or Shelley. Whether considered as self-revealing utterance of a great person or as the statement of a doctrine that has immensely influenced the course of modern thought, or simply as an example of magnificent imagination, ‘Tintern Abbey’ has a permanent place among the supreme achievements of English poetry.

MARION TUCKER

TINTORETTO, tén-tō-ret’tō, Jacopo, busti, son of a dyer (Italian, tintore) who was his usual surname, Italian painter: b. Venice, Sept. 1518; d. there, 31 May 1594. He was pupil of Titian, but was soon dismissed by master, perhaps through fear of rivalry. Thereupon worked without a master, taking
TINEID MOTHs (much magnified)

1, 2, 3 Feathered Moths
4, 5, 6 Common Moths
Other figures are details of the scales
TINWORTH.—TIPPOO SAHIB

TIPPECANOE, Battle of, fought 7 Nov. 1811 near the site of the present village of Battle Ground, on the Tippecanoe River, in Tippecanoe County, Ind., by about 900 Americans under William Henry Harrison (q.v.), who was then governor of the Territory of Indiana and a force of Indians nominally under "the Prophet," brother of Tecumseh (q.v.), but actually commanded by three chiefs, Stone Eater, White Loon and Winnebago. The Indians were estimated by Harrison at about 6,000, but were probably much less in number. Harrison encamped on the night of 6 November near the Indian village on the Tippecanoe River and while his men were asleep in the early morning of the 7th the Indians fell upon them with great fury and were only defeated and driven from the field after several hours of desperate fighting, in which the whites lost about 185 in killed and wounded, the loss of the Indians being unknown, though they left 40 dead on the field. The village was found on the 8th deserted and was burned by Harrison's men. For reasons of prudence Harrison then fell back to Vincennes. Consult Pitrle, 'The Battle of Tippecanoe' (1900), No. 15 of the "Filson Club Publications."

TIPPERARY, tip-ér-ár'i, Ireland, a town and the county-seat of the famous county of Tipperary in Munster. The town is situated 42 miles northwest of Cork and 110 miles southwest of Dublin. It has a large grammar school, several religious schools and butter and provision markets.

TIPPLE, Ezra Squier, American Methodist Episcopal clergyman: b. Camden, N. Y., 23 Jan. 1801. He was graduated at Syracuse University in 1834, took his Ph.D. there in 1836 and was graduated at Drew Theological Seminary in 1837. He served as a pastor in New York in 1837–1805, when he became professor of practical theology at Drew Theological Seminary. Since 1912 he has been president of that institution. He is a trustee of Syracuse University and is author of 'The Heart of Asbury's Journal' (1905); 'The Life of Freeborn Garrettson' (1917); and Francis Asbury (1916); 'The Drew Theological Seminary, 1867–1917' (1917), etc.

TIPPOO (or TIPU) SAHIB, ti-poo' sâ-hib, sultan of Mysore: b. 19 Nov. 1749; d. Seringapatam, Mysore, 4 May 1799. He was the son of Hyder Ali Khan, whom he succeeded in 1782. During the operations of the English troops under General Mathews in Malabar, he checked the advance of the British at Bednore, April 1783 and temporarily wrested Mangalore from its western invaders. In the following autumn he was compelled to surrender this province to Great Britain. In 1784 he was forced to sign a treaty of peace; but, continuing to intrigue, war was declared against him in 1790 and in 1791 he was defeated by Lord Cornwallis and obliged to surrender half of his domain and to pay 33,000,000 rupees to his English conquerors. In 1799 he was suspected of an alliance with Tipoo Sultan of Mysore, was defeated by the British and their allies, the Mahrattas. He was killed while fighting in this campaign. Consult Bowring, 'Haider Ali and Tipu Sultan' (1839).
TIPTON — TISCHBEIN

TIPTON, England, town in Staffordshire, situated six miles northwest of Birmingham. It has coal and iron mines, iron foundries, steam boiler and structural iron works, red and white-lead factories, cement works and brickyards. Pop. about 32,000.

TIPULIDÆ, the family of craneflies (q.v.).

TIRABOSCHI, tê-râ-bô'schê, Girolamo, Italian literary historian; b. Bergamo, 28 Dec. 1711; d. Modena, 3 July 1794. He was educated by the Jesuits, afterward joining their order and was for many years a professor in the University of Milan. He was a scholar of note, his greatest work being the 'Storia della Letteratura Italiana' (1772-83) in 13 volumes. He also published 'Biblioteca Modenesa' (6 vols., 1781-86), and 'Mемориал storiche modenese' (1793-94). He was librarian to Francis III, duke of Modena, from 1770.

TIRAILLEUR, tê-râ-l'yêr, a skirmisher, sharpshooter; the title was first employed by the French, in 1792, to denote light-armed troops thrown out from the main body to do skirmish work, feel the enemy, cover the movement of the main body, etc.

TIRASPOL, tê-râs'pol, Russia, a river-port in the government of Chernov, on the Dniester, 60 miles northwest of Odessa. It possesses five churches, two synagogues and a state bank. One of its chief attractions is its gardens. The principal industries are tobacco-raising and fruit culture. There are four factories and some trade is carried on.

TIRE, the outer hand placed around the fel lows of a wheel, made in various forms, for several purposes. The common tire for a wooden-carriage wheel is made of iron or steel and serves the double purpose of holding together the parts of the wheel and resisting wear in traversing the ground. The continuous steel tire is an American invention and consists of a flat hoop of steel usually of the same width and formed so as to fit tightly over the fellows; it is expanded by heating and put on in a heated condition; upon cooling it shrinks and tightly compresses the wheel. It is further secured by sunk-bolts through the fellows. The wire wheel made on a suspension principle, as in the bicycle, has a steel felloe with a concave outer surface for holding a rubber tire or a pneumatic tire. These have been highly developed in the bicycle (q.v.) and the automobile (q.v.); car wheels and locomotive wheels of cast iron or cast steel have usually tires of tough wrought steel shrunk on, so that the wearing surface may be as durable as possible. See Rumage Tire.

TIREBUCK, William Edwards, English novelist; b. Liverpool, 1854. He was for some years a writer on the staff of the Liverpool Mail and the Yorkshire Post, but in 1888 retired from newspaper life and devoted himself to writing fiction. His best-known novels include 'Summer's Eve' (1883); 'Horrid Missy' and 'Miss Grace of All Souls' (1895). He is also the author of an estimate of Dante Gabriel Rossetti (1882) and of a later work entitled 'Great Minds in Art' (1888), etc.

TIRESIAS, tê-rê-si-as, according to Greek mythology, a soothsayer of Thebes, reputed to have been struck blind either because he revealed to men things which they ought not to know, or because he had been by Athene conferred upon him the power to understand the language of birds, while Zeus bestowed upon him the gift of prophecy and long life. Tiresias has a poem on the subject of Tiresias (1885), who also figures in many Greek legends.

TIREMONT (Flemish, 'Tirment or Tirman'), Belgium, town in the province of Brabant on the Geete River. 11 miles southeast of Liége and 20 miles east of Brussels. There are two churches dating from the 12th c. Notre Dame de Laus and that of Sainmain. Saint Germain has a fine altar by Wappers. The town was taken by Marlborough in 1703; on 16 March 1815, was the scene of a victory by the French over the Austrians, and in the European War it was occupied by the Germans soon after the breaking of the war in 1914, remaining in German hands until the armistice. Industries include brewing and the manufacture of woolens, soap and engines. Pop. 17,581.

TIRPITZ, Alfred von, German admiral; Kuswitz, 1849. Graduating from the Academy when only 12 years of age, advanced rapidly, and in 1896 was State Secretary of the Navy and in 1898 Minister of State of Prussia. In 1911 came his promotion to post of Lord High Admiral. He took a great interest in the development of the submarine and had immense faith in this arm of the sea. He is credited with having organized the submarine blockade of the British Isles in 1915-16. When he carried his idea to the extent of sinking unarmed vessels, participating in the torpedoing of the Lusitania, he aroused such indignation in neutral circles that the unwisdom of the policy was apparent and his resignation was arranged although the assigned reason was his ill health. See War, Eternal.

TIRYNs, tê rin's, Greece, in Argolis, miles southeast of Mycenae, an ancient city a rocky height which formed the Acrope beneath which another city extended down the plain. The town was destroyed 400 B.C. Much of the citadel and of the acropolis with their pointed gates are still standing, together with some interior passages or galleys of similar construction. The excavations conducted by Schliemann in 1874-85 resulted in the discovery of a magnificent palace, comprising various buildings and approached in style. The complete arrangement of halls and private apartments is apparent, and the like Schliemann, 'Tiryns' (1885); Perrot and Chipiez, 'Histoire de l'Art dans l'Antiquité' (Vol. VI, 1894) and Baedeker's 'Greece.'

TISCHBEIN, tish-bén, Johann F. August, German painter; b. Maastricht, 1812. He studied with J. Heinrich Tischbein and in Paris and after serving as court painter in Wurtemberg became director of the Kupferstich Acad. 1810. He painted many noteworthy works, including nine of the princes and princes of Orange-Nassau (Amsterdam) and Schiller, which he finished in 1804.

TISCHBEIN, Johann H., German painter; b. Haina, 3 Oct. 1722, d. 1779.
TISSHANDER, Tisserand

French aeronaut: b. Paris, France, 21 Nov. 1843. He was the inventor of a dirigible balloon in which he made an ascent of five and one-third miles, from Paris in 1875; he alone surviving of the members of the aeronautic experiment. Besides his written contributions to the subject of aeronautics he has contributed to the Library of Wonders series, well-known volumes on the subjects of light, water, coal and fossils.

Tisserand, François Félix, French astronomer: b. Nuits-Saint-Georges, Côte-d'Or, 15 Jan. 1845; d. Paris, 20 Oct. 1896. He was educated at the Ecole Normale Supérieure and in 1866 became adjunct professor at the Paris Observatory. He took his doctor's degree in 1868 with a thesis which was a brilliant extension of the scope of the method of Delaunay. He went to Malacca to observe the solar eclipse of 18 Aug. 1868 and in 1873 became director of the Observatory at Toulouse. He was a member of the French expeditions observing the transit of Venus, in Japan, in 1874 and in Martinique in 1882. He was elected to the Academy of Sciences in 1878; in 1883 became professor of celestial mechanics at the Sorbonne; and in 1882 was appointed director of the Paris Observatory. He made many valuable investigations in the field of celestial mechanics and wrote brilliantly on the subject. The results of his own labors and that of others in this field are presented in his mastery and simplicity in his Traité de mécanique céleste (4 vols., 1886-96). He revised Lalande's catalogue and was editor of the Bulletin Astronomique.

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TISSOT, tê-sô, Claude Joseph, French philosopher: b. Fours (Doubs), 26 Nov. 1801; d. Dijon, 7 Oct. 1870. He translated the larger part of Kant's writings into French. Among his original works are 'Of the Beautiful, Especially in Literature' (1830); 'Short History of Philosophy' (1840); 'The Mania of Suicide and of Revolt' (1840); 'Parcelling of the Land and Division of Property' (1842); 'Principles of Morality' (1860); 'Catholicism and Public Instruction' (1874); 'Insanity Considered Especially in Its Relations to Normal Psychology' (1876).

TISSOT, James, French painter: b. Nantes, 15 Oct. 1836; d. Abbey of Bouillon, 8 Aug. 1902. He was a pupil of Ingres, studied in London under Seymour Haden, and attracted attention by his brilliant pictures of fashionable women, actresses and grissettes, as in his 'Promenade in the Snow' (1859). His series of etchings 'Parisian Women' was very popular. He suddenly changed his whole artistic aim in life under the stress of a sudden bereavement and went to Palestine (1860) where he lived nine years with the youth and rural activities of the Holy Land for the purpose of producing a set of pictures illustrating the life of Christ. These paintings were subsequently reproduced by Lecommetier in Paris under the title 'La vie de notre Seigneur Jesus-Christ'; and a parallel publication of them has been issued in this country. The original drawings and paintings, 540 in all, are now in the Brooklyn Institute of Art. Just before his death he began his paintings illustrating the Old Testament.

TISSUE, in biology, a group of similar cells in an animal body (or a plant) which form a definite fabric, having the same origin and discharging the same function. Tissues are classified according to their structure when completely developed, in accordance with their functions, or with reference to their mode or origin. A common classification of animal tissues includes cellular tissue, connective tissue (q.v.), epithelial tissue, (see EPITHELIUM), circular system, (see VESSELS), skeletal system, (see BONE), cartilage, (see HISTOLOGY); parenchyma.

TISZA, i-tzo-, Stephen, Count, Hungarian man: b. Budapest, 1861; d. 31 Oct. 1916. He was educated in Leipzig, Heidelberg and Vienna and was app. to a post in the Hungarian Ministry the Interior in 1882. He was elected the Hungarian Parliament in 1886, became a strong of close relations with Austria. He was premier and Minister of the Interior in 188, losing his seat in Parliament at 41; time that his ministry fell. He was appointed Premier 10 June 1913, and that office at the outbreak of the World War in 1914. He was thoroughly in sympathy with the war and was regarded as one of the chief authors. Growing dissatisfaction with the continuation of the war, and over the demands for suffrage and other reforms, Tisza was unwilling to grant resulted in bringing about the fall of his Cabinet in 1917 and he resigned 13 May 1917. In 1918 he was assassinated.

TITANIA, according to Ovid, a Nymph, a daughter of the Titan Atlas. Shakespeare in 'Midsummer Night's Dream' gives the name to the wife of Oberon.

TITANIFEROUS IRON Ores, chiefly varieties of the minerals ilmenite and magnetite. Ilmenite (q.v.) is called titanite ore and is richer in titanium than either of the others. The valuable ores for both iron and titanium, which has been questioned, seems at least to be established. The remarkable attraction of titanium for iron suggests its use in freeing iron from blow-beds, while titanium steel is a possess remarkable toughness and strength. Much excellent work has been done by Ross in pointing out the merits of titanium steel and in developing processes for the extraction of titaniferous iron oxide. The important known occurrences of titanium, in Norway, Quebec and the Adiron -dents, in each of which regions there are of vast extent. These occurrences are exhaustively described in papers by and J. F. Kennedy.

TITANITE, a mineral occurring in clinohumite, often wedge-shaped and
the composition of calcium silico-titanium is adamantine to resinous; hard to 5.5; specific gravity about 3.5. Partly common, while prismatic cleavages are seen in the variety from black crystals, sometimes bev- 
ed in diameter, occur mostly in lime- 
$n$ Saint Lawrence County, New York, 
Canada. The variety sapphire is usually 
green or golden yellow, and often occurs as or chlorite chalcedony in transparent or 
vent twin crystals. Owing to the high 
ve and dispersive power of such crystals, 
rare beauty and inferior to none but the 
d in their play of colors, may be cut 
lem, though they lack durability owing 
low degree of hardness. The finest of 
em sapphires are from Switzerland, the 
Delaware County, Pennsylvania and 
ober, New York.

**TITANIUM.** See Electro-chemical Ind- 
$\text{i}$; Mineral Production of the United

**ANOSUROS,** a genus of huge sauro-
dinosaur. See Dinosauria.

**ANOPIUM.** See Brontothere.

**'ANTS, ti'onz, in Greek mythology, six 
$\text{i}$ a six daughters of Uranus and Ge, 
Oceania, Koius, Kretus, Hyperion, and Kromius; Theia, Rhea, Themis, 
syne, Phebe and Tethys. Uranus hav-
ished to Tartarus the Hekatoncheires 
undred-handed') and the Cyclops, Gaia 
the Titans to avenge his brothers, 
ise and freed them, deposed Uranus, and 
nus in his place. Kronus and the Titans 
their turn put down by the sons of 
and Rhea, named the Olympi, with Zeus 
head, but not till after a long struggle, 
Zeus brought to him the aid of the Cyclops 
hekatoncheires, whom Kronus had given 
ad in Tartarus. Zeus quelled the Titans 
é lightning given him by the Cyclops, 
them to Tartarus, placing them under 
$\text{e}$ of the Hekatoncheires. This struggle, 
the titans, was regarded as sym-
: the conflict of reason and order with 
forces of nature. Consult Mayer, 
gante und Titanen in der antiken Sage 
(1887).

**CHENER, tich'en-er, Edward Brad-
American psychologist; b. Chichester, 
11 Jan. 1807. He was graduated from 
in 1890, and afterward studied in Leip-
gamas to Oxford as extension lec-
nals, but was called to Cornell 
ity, Ithaca, N. Y., in 1892, as assistant 
$\text{r}$ of psychology, and in 1895 became 
$\text{e}$ ofessor of psychology there. His writ-
lude (A Primer of Psychology) (1898); 
mental Psychology (1901); Text 
of Psychology (1910); A Beginner's 
y (1915). He is also editor of the 
Journal of Psychology.

**E, Sir William, British architect; b. 
Feb. 1708; d. 23 April 1873. He 
in the work of rebuilding the body of 
unstan-in-the-East in 1817-20; was en-
hanced to the office of Surveyor General 
in 1827-28; and was one of the de-
Loudon and Westminster Bank, 
Lothbury, in 1838. He rebuilt the Royal 
Exchange in 1841-44, a work which is considered 
his greatest achievement as an architect. He 
designed the earlier English railways stations as 
well as those on the line from London to Paris, 
France. He planned the Woking Cemetery in 
1853-54; was a member of Parliament from 
1855 until his death; and was knighted in 1869. 
Author of 'A Catalogue and Description of the Antiquities Found in the Excavations for the Royal Exchange' (1848).

**TITHES, taxes, either voluntary or com-
pulsory, consisting of one-tenth of the income 
taxed. Usually tithes were one-tenth of the 
annual profit of the land and were paid for 
purposes of church support. The custom is of 
extreme antiquity. In Genesis xiv, 20, Abra-
ham allows a tenth of the spoils taken from 
four kings to their victor. Moses allowed 
tithes for the support of the Levites and for 
service in the temple (Lev. xxvii, and Num. 
xxix). In 778 Charlemagne commanded tithes to be collected within all the provinces of the 
old Roman empire over which he ruled; this 
was for the support of the Christian Church. 
These tithes were by him allotted to four dif-
ferent uses: one part was for the maintenance 
of the edifice of the church, and the other 
third, severally, for the support of the bishop, the 
clergy and the poor. Ecclesiastical tithes were 
always more or less oppressive in their opera-
tion, being unevenly imposed, but after their 
introduction into Great Britain they were 
systematized. They were first enjoined in 
England in 786 and in 794. Offa, king of 
Mercia, gave the Church all the tithes of his 
kingdom, and this law was subsequently 
made general for all England by Ethelwulf. 
When dioceses were divided into 
parishes the tithes of each parish were allotted 
to its minister, at first by common consent, 
but afterward, about 1200, by the law of the land 
in England. The custom of paying tithes 
became established in Germany and France about 
the same time, the 9th century, and in the 
Scandinavian countries in the 11th century. 
At first the payment of the tax was always 
kind, that is, in grain, livestock, wool, etc., and 
such tithes were known under the heads, 
namely, prudial, or those which arise 
immEDIATELY from the soil, as grain, fruits 
and wood; mixed, or those consisting of natural 
products but nurtured by the care of man, as 
calves, lambs, eggs, cheeses, wool, etc.; 
and personal, or those arising from the profits of 
personal industry as in the pursuit of some 
profession, or some trade of livelihood. With 
regard to their value tithes were divided into 
great and small; great tithes being grain and 
wood, and belonging to the rector, and small 
tithes being the other prudial tithes with 
the mixed and the personal tithes, and belonging 
to the vicar.

Tithes proved a source of great trouble in 
every country in which they were collected and 
insufficient idea of how often they were 
ripped in the church and the people. They 
have, therefore, been abandoned in nearly all countries except England, where they are still retained. There they have 
been the cause of constant friction between 
the people on the one hand and the officers of 
the law and the clergy on the other. Under 
Henry VIII, the owners of certain great estates
were relieved of the duty and this increased the feeling of the tithe-payers that their burden was too great. In three-fourths of Ireland it was found impossible to collect tithes, for long periods at a time, and the enforcement of the law, especially in cases of non-members of the Church, was not infrequently accompanied by violence. As a result, the practice of collecting the tithes by the clergy was replaced by a system of annual assessment, which was more convenient and more acceptable to the people. The matter has been the subject of much legislation by Parliament, which has generally established in lieu of the old system a fixed money rent charge payable annually. Consult Clarke, H. W., 'History of Tithes' (1891); Degeée, S., 'The Parson's Counsellor with the Law of Tithes' (1820), and Selden, J., 'History of Tithes' (1618).

TITHING, an old English subdivision of the population. It consisted of a company of about 10 households, one of the integral parts of a hundred (see Statute), who were regarded as a distinct political division for some purposes of police and civil regulation. At its head was a tithing man, who was directly responsible to the officers of the Crown, the several members of the tithing being bound for the peaceable behavior of each other. The institution of the tithing has passed away, the tithing man has evolved into the police constable, but in some parts of England British conservatism still preserves the name and the corresponding territorial distinction.

TITHING MAN. See TOWN AND TOWN MEETINGS.

TITHONUS, thi-tho'nis, a son or nephew of Laomedon, king of Troy. He was beloved of Eos (Aurora, Morning), who induced Zeus to make him immortal. Her prayer was granted but she had neglected to ask for perpetual youth, and in time her lover took on all the signs of extreme age. Tithonus prayed to the gods to be relieved of this 'terrible immortality, and was metamorphosed into a grasshopper. Thomas has written a remarkable poem, 'Tithonus,' on this mythological incident.

TITIAN (Tiziano Vecelli), the greatest painter of the Venetian school and one of the world's greatest painters: b. Pieve in Cadore, a district in the Venetian or Carnic Alps, 1477; d. Venice, 27 Aug. 1576. He was the son of Gregorio di Conte Vecelli, a descendant of an ancient family and a man of some note in his province. It was the custom of this family to follow arms of the law, but young Titian showed such genius for art that at the age of nine or ten he was sent to Venice to learn painting. He studied under Gentile Bellini and afterward with Giovanni Bellini and then attached himself to Giorgione, who was the idol of the day. The delicate, exquisite frescoes for the Fondaco dei Tedeschi, the exchange of the German merchants in Venice. After Giorgione's sudden death by the plague in 1510, Titian completed several of his master's works. Titian'sown pictures show much similarity to Giorgione's and are often referred to as 'Giorgionesque Titians.' One of the most famous is 'Sacred and Profane Love' (in the Borghese Gallery, Rome), about which so much has been written. To this period belong the 'Virgin and Child' (Vienna Gallery), 'The Virgin and Child with Canon Zizanegalli' (Paris); Bishop of Paphos, or 'Buffon' (Antwerp, Gallery); 'Saint Mark' (in the Salute, Venice); the 'Three Ages' (Bridge-water Gallery, London); Madonna of the Cherries (Vienna Gallery); Daughter of Herodias (Dresden Gallery); 'Christ with the Tribute Money' (National Gallery, London).

In 1511 Titian went to Padua to paint frescoes in the Senola di S., and returned to Venice in 1513, where he became superintendent of government works and was ordered to complete the paintings left unfinished by Giovanni Bellini in the Hall of Great Council of the Doge's Palace. Her painted the portraits of three successive Dukes of Ferrara, for whom he painted charming works, including the 'Worship of Venus' and the 'Bacchanal,' with Aegina over her wine-cup (both in the Alte Pinakothek, Munich, and the superb 'Judging of Cadmus and the Superbia' (in the National Gallery, London). At this period he formed a friendship with Aretino, whose portraits he painted. In 1517 while painting these delightfully decorative pagan triumphs of Bacchus and Venus, he began work on the 'Assumption,' or 'A Life of the Virgin,' for the church of the Frari, Venice (now in the Academy). This was finished in 1518 and caused a sensation, for it was considered the astonishing performance in color on a scale that had as yet been executed. The gallery now preserves the famous 'Presbytery of the Virgin,' a large and much picture, and one of Titian's masterpieces. In 1526 he completed 'Pesarva Madonna,' on which he had worked for seven years. This is still in the church of the Frari and represents the Madonna, crowned with adoring saints, including George, and members of the aristocratic family beneath the group. (Also in the Louvre), belonging to the Duke of Northumberland, is a work of the same general character. "Entombment of Christ" (in the Louvre), another early work, and "Christ Crowned with Thorns" (also in the Louvre) still shows influence of Giorgione.

In 1525 Titian married. Nothing is known of his wife, who died in 1530, leaving one child, the infant Lavinia. Titian painted so many beautiful portraits of this noted and beautiful child that it was a long time before he could find a model to compare with them. In 1532 the portrait of Charles V, the emperor, was begun and was, in consequence, created P. Latine and a Knight of the Garter. His two sons were also made nobles and he was made a baron, an unusual honor for a painter. From this time onward Titian enjoyed a success greater than that any other painter had awarded to them, with the exception of Raphael, Michelangelo and Rubens. D'Archiac, Marquis des Vasto, gave
and Charles V, an amity of 2,000
afterward doubled) on the treas
try. When visiting Rome in 1546 he was
freedom of the city. In 1550 he
the first great painter of his time he
helped his suit for the hand of
England. Notwithstanding the
ments that Titian visited Spalato, modi-
ties affirm that he never was there.
d much in Italy and went to Augus-
tine at the Council of Trent in 1555.
went to Cadore to design decora-
he church at Pieve, his native town.
most of his life, however, in Venice,
worked until the last moments of his
tri saw him with brushes in hand
uously. Titian was, according to
rities, 99 when he died of the plague
in Venice. Vasari gives his birth-
t Titan, writing to Philip II in 1571,
us that the famous painting of Fran-
ci near his famous painting, the
di Casa Pesaro, 3 Canova's monu-
marks his grave. His son, Orazio,
plague a few days after Titian. He,
he, a painter, but overshadowed by his
was his successor in the chancery of
the plague. Titian's splendid villa was
d plundered by thieves. Titian's last
as a 'Pictor,' which was finished by
vines. Although Titian lived in grand
had many orders, he seems to have
trouble in collecting his payments;
response is full of appeals to his
he gave splendid entertainments and
the most brilliant men of the age.
ed when Henri III of France
ough Venice on his way from Poland;
French throne, he called on Titian
ite of noblemen and that the painter
him as a gift with all the pictures of
quired the price.
allowing for the abnormal length of
ional career, Titian's prolific facility.
More than a thousand pictures in
and American galleries are attributed
These 250 are spurious or dou-
tautographs, small wood engravings,
the druid. The Uffizi has 18; the Pitti,
Museum, seven; the Venice Acad-
; the Louvre, 18 and the National
ondon, six. Some critics accord the
onces 1 in the Louvre, which has long
order a Giorgione, to Titian.
was a man of correct features and
person," writes William M. Rossetti,
comânnon of penetrating observa-
possessed composition — a Venetian
ly to pair with any of the most
ave and reserved signors, whom
transferred to posterity. He was
in the Louvre) health and
unequaled. He was not a man of
genius or varied faculty and accom-
Leonardo da Vinci and Michæl-
's one great supreme endowment of
painting. Titian's art properly be-
as the greatest manipulator of paint
1 to color, tone, luminosity, richness,
fitness, surface and harmony and with
the production of a pictorial whole
converging to the eye, a true, dignified
and beautiful impression of its general subject
matter and of the objects of sense which forms
its constituent parts. In this sense Titian has
never been deposed from his sovereign power of
painting. Titian's pictures abound with mem-
ories of his home country and of the region
which led from the hill summits of Cadore to
the Queen City of the Adriatic. He was al-
most the first great painter to exhibit an ap-
nreciation of mountain, mainly those of a
turretted type, as exemplified in the Dolomites.
Indeed he gave to landscape a new and original
vitality, expressing the quality of the objects
of nature and their control over the sentiments
and imagination with a force that had never
been before approached. The earliest Italian
picture expressly designated as 'landscape' was
one which Titian sent in 1552 to Philip II.
Naturally a good deal of attention has been
given by artists, connoisseurs and experts for
probing the secret of how Titian managed to
obtain such extraordinary results in color and
surface. His figures were put in with the
brush dipped in a brown solution and then
altered and worked up as his intention de-
veloped. In his earlier pictures the most
useful color rests mainly upon red and green; in
the later ones upon deep yellow and blue. The
pigments which he used were not unusual;
indeed they were both few and common.
Palma Giovio records that Vecelli would set
pictures aside for months and afterward ex-
aming them as if they were mortal en-
emies would set to work upon them like a man
possessed. Also that he left many pictures in
progress at the same time, turning from one to
the other, and that in his final operations he
worked far more with the finger than with the
brush.
Titian seems to have taken Palma
Vecchio as his model for softness and Giorgi-
one as his model for richness. He distanced all
his predecessors in the study of color as ap-
plied to draperies.
Titian excelled in every style. The 'Assump-
tion of the Virgin' is ranked as one of the
world's greatest pictures and the 'Entombment
of Christ,' the 'Christ Crowned with Thorns'
(Louvre), the 'Ecce Homo' (Vienna Gallery),
in which Aretino posed for Pilate, the 'Sup-
ner at Emmaus' (Louvre), 'Saint Mark'
(Salute, Venice), the 'Presentation in the
Temple,' 'Christ in the Garden' (Madrid),
'Noli me Tangere' (London) and 'Saint
Jerome' (Barera, Milan) attest his power in
religious subjects. An exuberant fancy and
dash characterizes his delightful mythological
production such as 'Bacchus and Ariadne'
(National Gallery), 'Bacchus and Ariadne'
('National Gallery'), 'Worship
of Venus,' 'Diana and Actaeon,' 'Callisto,'
'Jupiter and Antiope,' 'Europa,' 'Venus'
(Pondo), 'Venus and Cupid' (Florence),
'Danae' and 'Venus and Adonis' painted for
Philip II, 'Venus Anadyomene' (Bridgewater
Gallery), the 'Madonna of the Cherries'
(Vienna) and the 'Madonna of the Rabbit' or
'Madonna del Consiglio' (Louvre) prove that his
'Virgin and Child' can stand comparison
with any other great master in Italian art. As
portrait painter Titian is unequalled. Accord-
ging to Vasari 'There has scarcely been a
noble of high rank, scarcely a prince or lady
of great name, whose portrait has not been
taken by Titian.' His list of famous men and
women is long. Perhaps at the very top stands the unknown ‘Man with the Glove’ (Louvre), young, hand-some and charming. Many times was the Duomo of Urbino, containing four superb studies: Catarina Cornaro, Queen of Cyprus, Sandovino, Francesco, Duke of Urbino and Eleanora, the Duchess of Urbino. Charles V on horseback at the battle of Mühlberg, now in the Prado, Madrid, shows what kind of man the emperor was. Titian painted three portraits of himself: one in early life (Vienna), one in middle age (Berlin) and one in old age (Prado, Madrid). Francis I (Louvre), though a great portrait, was not painted from life, for Titian never saw this sovereign. The famous work in the Louvre called ‘Titian and his Mistress’ represents Alphonso, Duke of Ferrara and his wife Laura di Dianti. Pope Paul III was another fine sub­ject for ‘Vittoria’ or ‘Last Judgment’ in which Charles V appears, so loved by the emperor that he had it in his room during his last illness and kept his eyes fastened on it till the last. Titian also painted one great historical work in 1559, ‘The Battle of Cadiz,’ representing the moment when the Venetian captain, facing the enemy, dashed into the rushing stream with men and horses. All are re­presented life size. This picture perished by fire in 1577 and is only known to-day by Fontana’s engraving and a sketch by Titian in the Utzizi.

‘Titian,’ writes Kugler, ‘was born in grand Alpine scenery amidst a sturdy and vigorous race; and it is in the combination of these ances­ceds with the gorgeous color and splendid forms of Venetian life that we trace that breadth of qualities so conducive to the develop­ment of art in which he takes precedence of every other painter. Two forms of nature especially courted his pencil—landscape and portraiture; and in each he revealed to the world treasures of truth and poetry not worked out before. For Titian is not only the painter of humanity in its largest distinctions—in the beauty of woman, the dignity of man and the artlessness of childhood—but he is especially the delineator of all those under every aspect of the high born and the affluent placed classes of society. Sir Joshua Reynolds says of him whatever he touched by a kind of magic he invested with grandeur and importance. The intellectual, the noble, the splendid, the well-formed, the well-dressed, were the mutual subjects of his art. His type accordingly of Christ, John the Baptist and the Virgin in which the pride of life and the abnegation of self are incompatible qualities cannot satisfy those who look for the realization of a sacred idea. Titian can, therefore, hardly rank as a painter of religious feeling, but in whom the pride works when the waves still influence of Giorgione.”


ESTHER SINGLETON

TITICACA, tê-tê-kâ’kâ’, the largest lake in South America and one of the most remarkable on the globe, situated on the southeastern boundary of Peru, its eastern shores belonging to Bolivia. It is about 130 miles wide and 39 miles wide through most of its length, though 43 miles at one point. It lies at an altitude of 12,635 feet, in a large plateau basin between the two main cordilleras of the Andes. It is of irregular shape, and contains several islands. Copacabana Peninsula almost cuts it in two at the southeast extremity. The greatest depth is 720 feet. Its surplus water is discharged southward by the river Desaguadero, which flows into Lake Ullagagas, and thence disappears in the Salinas Grandes, so that it in whose way the lake does not reach the ocean. Lake Titicaca was formerly much larger than now, and is still decreasing in area. There are geologic evidences that it formerly discharged into the Amazon watershed, in the eastern side of the Cordillera Real. In spite of the high alti­tudes the shores are inhabited, and steamers ply on its waters. The largest island in the lake also bears the name Titicaca. Puno is the largest town on its shores, which was the seat of a prehistoric civilization of great interest, and the islands and the regions around the lake contain some of the most interesting architectural remains of ancient Peru.

TITLARK, a small lark-like bird of the family Motacilleta, many species of which inhab­it most parts of the world in every variety of region, some being migratory, others per­manent residents. The nest is made upon the ground, or dry grass and stalks, lined with finer plants and hair, and the eggs are four to six. The American titlark (Anthus rubescens) has six and one half inches long; its back is brown; the tail is black; its head, facial region and neck are greenish; the under tail and innermost tail feathers are white. It is very generally distributed over North America, extending to the Pacific and to Green­land, and is accidental in Europe. The flight is exceedingly easy and graceful; it occurs in flocks of tens or hundreds, running fast on the ground, vibrating the tail whenever it stops, not squatting like the larks, but moving the body on the upper joints of the legs. It is found in the fields, on the prairies, along rivers, and on the seashore; the notes are clear and sharp, the last much prolonged; it breeds in the East only north of the Cape Fear River, and especially in the coastal districts of Labrador; but in the Rocky Mountain region it spends the summer much farther south, but in cool elevations. This bird is very similar to the A. olivaceus of Europe, though the latter has a longer bill and less arches.
ens, and has no yellowish supercilium: the outer tail feathers are not white, but the eyes are less distinct below. Among the European species the most extensively dissected is the meadow titlark or pipit (A. sciu), which is a favorite field-bird in Britain. The tree-pipit or titlark (A. variegatus) is another favorite. Both are kept in gardens. Consult general works, and 'Birds of the Northwest' (Washington

TITLE-DEED, a paper, or one of several written, printed, or partly written, describing a property in and through which ownership or authorship became into the present custody, by virtue of a person claiming ownership or title. It is often used in the plural to denote several muniments of title turned over or granted on delivering the property to the one or his agent and in this sense title means any documents containing evidence of title or any part of the title to real or other property so granted. Every one is supposed to have his own deeds, but the modern system of registerable estate transfers requires an official of the title-deeds to be entered in the title of the registrar or of whatever public assumes the duties of registrar, and be open to the public inspection.

TITLE INSURANCE is effected in count-, having public offices for the record of to real estate through the agency of title companies. This business has as much importance in the United States where a system is most fully developed. In this y law requires all transfers of real estate, mortgages, wills, judgments, etc., to b dead in official registers open to public inspec-. In the larger cities these records became so voluminous that the matter of titles became a cumbersome affair calling for the prolonged services of expert real-ty. Moreover such research was attended with long delay and with great expense; yet it had to be repeated every time a fresh or mortgage took place, since the or mortgagee was not apt to accept the title without assurance of its being un-laid and sound in title. Finally in 1876 Philadelphia company was organized to enter titles, and the plan proved so suc- that companies have since been organized nearly every large city in the country. An operation of these companies calls for an independent and sometimes inaccurate method of public record offices the title insurance into their own records of real titles in the locality in which the they need must maintain for this purpose a staff of expert title examiners. On account of the size of its force a well-equipped company can make the first examination and put of a title in less than a week, whereas one to three months was sometimes re-by the practising attorneys. The fee is fixed, but in this instance it is usually about me as that charged by a reliable lawyer, case of a long examination, about one per cent of the value of the property assessed; but it has the added advantage of guaranteeing against loss if there is any inaccuracy of the search. After a property has been once examined, it is then clear that, the noting of future transactions affecting it is a simple matter, and subsequent guaranties are issued upon short notice and for a small fee.

TITLE TO PROPERTY. See Realty.

TITLE REGISTRATION, a system of public records under which titles to real property are recorded in public offices for the purpose of expediting the process of transfer and of giving legal notice to claims of ownership to lands so entered. In England the registration of titles is of comparatively recent introduction, the system being due to the land transfer acts of 1875, under which it was first successfully practised. The office of record in that country is conducted by a registrar ap-pointed by the lord chancellor, who also fixes the fees for the various services of the office. These fees, paid in the form of stamps, provide the emoluments of office from which the registrar draws his pay. Under the act of 1875 the registrar must approve of the title submitted and in case of a sale the vendor must make affidavit that he has produced all the deeds, wills and other instruments of title as well as all the evidences of encumbrances on the land, in order that the registrar can make a fair entry. When once a title is registered no adverse title will acquire any advantage by length of possession, but any person claiming an adverse interest can lodge a caution of that fact and be entitled to notice of all further transactions on the property. When the register-terd land is sold the name of the transferee is entered on the register and he is issued a certificate of title. The law is not compulsory in England, but is being gradually adopted because of its advantages over the old system.

In the United States it early became customary to register titles, mortgages and notices of transfer of interest, encumbrances, etc., in public offices, usually in the office of the county clerk of the court. This officer has no judicial or discretionary powers and is empowered only to register official copies of deeds, mortgages, agreements, etc. In place of the old certificate the clerk notes on the original or a duplicate deed that a true copy has been entered on the official register and this copy becomes legal notice of claim of title to all the world. The clerk of the court, who is a county officer in the United States, and elected, not appointed, frequently delegates this part of his work to an appointed assistant known as the registrar of deeds. Between the parties of a conveyance the recording or non-recording of the instrument is of no moment, but conveyances made after the first is rec-orded are void, and any conveyance not re- corded is void as against a subsequent conveyance to a bona fide purchaser from the person in whose favor a recorded conveyance has been executed. State regulations, however, usually govern the matter of registration in regard to its effect as constructive notice. For the *Australian system* of national land registration, see Torrens System.

TITLES, words or phrases bestowed on individuals as a mark of distinction, rank or
dignity, and in some cases implying office or vocation. Titles may be official, honorary, civil, military, or temporal or ecclesiastical. The use of titles is as old as civilization and seems to have arisen from titles bestowed for some public service, and only later to have been bestowed in virtue of the dignity of the office or employment of the recipient, and even later to have become hereditary. As used by the Greeks and Romans, however, titles conformed to the first and the last customs—they were bestowed for service and were hereditary. Later, Roman officials carried their titles with them irrespective of the merits of the holders, for example, the names Cæsar and Augustus, and the phrase pater patriae, all of which came to be applied to the imperial throne regardless of the character of the occupant.

Titles today in existence in Europe are interesting relics of the feudal period. First came the titles of count and duke. Counts (comites, companions) were the followers of the feudal lords and the dukes (dux, leader), the military leaders of the people. Later came the appellation marquis to denote those in charge of the marchi, marshes, usually on the frontiers or border lands. Under the count came his lieutenants with the title of viscounts. Among modern rulers the titles marquis, earl, and viscount are often given to important feudal personages, the great tenants-in-chief of the Crown. The knight was he who had received an order of chivalry or knighthood, and so on through the several grades of feudal society.

Among modern rulers the titles king and emperor with the feminines and in the case of the late Russian Empire that of tsar, are the titles of supreme heads of government. The title king harks back to a period when its bearer was chief of a knightly band as the head of his tribe. The later rex and its derivatives in the Romance languages denotes a ruler. And the word emperor, which is used in the same sense, originally denoted the ruler of an empire or a confederation of several states, each of which had a king at its head. In this respect the word was advisedly applied to William II, late emperor of Germany. Meanwhile it had become customary to add to the titles signifying the office, honorary qualifying titles. Henry IV of France was called "Gracieux"; Edward IV, "Most High and Mighty Prince"; Henry VII, "Highness"; and Henry VIII, "Majesty." This latter title was universally adopted by the sovereigns of Europe, and was subsequently subjected to further qualification, and the title of James, I, who was called "His Sacred Majesty of England," and was formally addressed as "James, by the Grace of God, King of Great Britain, France and Ireland, Defender of the Faith, etc. Catholicae," and upon admission his elevation, as "Cætholica," for Spain, "Most Faithful" for Portugal, etc. The present ruler of Great Britain receives the title, "George V, by the Grace of God, of the United Kingdom of Great Britain and Ireland and of the British Dominions beyond the Seas King, Defender of the Faith, Emperor of India," and the eldest son of the British sovereign is styled Prince of Wales, and the eldest daughter Princess Royal; the other sons and daughters are styled prince and princess, and all those with the children of the sons of the sovereign, are addressed as Royal H. The five orders of nobility in Britain distinguished by the titles of honor—marquis, earl, viscount and baron. Nobles have several titles, granted by patents, in their progressive steps in the peerage. A duke may thus be a marquis, an earl, a viscount, and a baron. One of the inferior is permitted as a matter of social dignity and assumed by the eldest son. Thus the son of the Duke of Sutherland takes his courtesy title, as it is called, of Marquess of Stafford. Courtesy titles do not raise the bearers above the rank of commoners, consequently the eldest sons of peers are eligible for election as members of Parliament. The title of esquire and master (Mr.) are now indiscriminately to nearly all classes of sons. The Continental titles of prince, marquis, count, viscount and baron, differ considerably from the corresponding titles in England. Thus in England the prince is confined to members of the royal family; Austria has, or had, archdukes but dukes, Russia had only grand dukes.

It is an axiom that hereditary titles their value in proportion as they become common. In England this latter danger is obviated by the rule of primogeniture which insures that there shall be but one bearer of a title in a generation, while in France all the sons receive titles, the eldest the highest title, for instance, that of duke, the second son, marquis, and so on. In Mohammedan law, only hereditary title is that of sherif in the ruling houses. Pasha and bey, as purely military titles, are now conferred on civilians, but are not hereditary. Japan, a system of titles closely resembling that of Europe, and like the latter, based on a feudal system. China, under the empire, added the ancestors of the person to honor and usually made the title hereditary for a stated number of generations. Turkish sultan is style pâhâsh (lord king) as head of Islam he is "the Commander of the Faithful." The ruling houses of India graduated system of titles closely akin to that of Europe. The Pope of Rome is thus the title "His Holiness," and addresses "Your Holiness," cardinals by the title " Eminence," bishops as "Monsignor," England as "My Lord." The title of "The Lord Bishop of," of a see, the "Most Reverend the Lord Archbishop," deans and archbishops as "Very Reverend," all men and ministers of the Christian Faiths are now generally styled " Reverend." Titles in the United States—
and other titles of nobility are forbidden to Federal Constitution and the citizen of the country who bears such a title when he uses a citizen of the United States must use his title. Various offices of dignity must carry with them certain forms of address, but these forms of address pertain to offices alone, and the holders of these offices have no claims to the prescribed form of address after their terms of service have expired.

The President, governors of States, and members of Congress, heads of departments, int secretaries, comptrollers and auditors, treasurers, clerks of the Senate and House representatives, State senators, law judges, of cities, etc., are entitled "Honorable." Officers of the navy, naval, ecclesiastical and other prawn dignities are distinguished by the common to the English-speaking peoples in the world. Consult the Almanach de Gotha, Burke's Peerage, Complete Peerage (new ed., 1910);Phillips, or Alison, Titles of Honor (in Encyclopaedia Britannica, Vol. XXVI, Cambridge

**TITLES OF HONOR.** See Orders and Decorations, Titles.

(TMARSH, M. A., or Michael Angelo, idiom employed by Thackeray when using his Paris Sketch Book, Yellow-Papers, etc., to Fraser's Magazine.

**TITMOUSE,** one of the diminutive birds of the subfamily Parinae, family Passeridae, which mong the most interesting of passerine birds. There are more than 75 known species, widespread over most parts of the world, but most abundant in the rate and colder regions of the northern part. None of them are really migratory, though many roam widely during the winter in search of food, nor are they migratory, though in this particular also stress of weather frequently causes them to gather in flocks, often with other small birds, as red-wings, etc. They are not songbirds, h most of them have characteristic, and ently musical, call notes, and during the breeding season they sing after a fashion, weakly. They are very active, restless, ar birds, usually showing little fear of and sometimes coming about houses in continual search for food. They eat thing from seeds to the eggs and young. The nesting habits are varied, and lay numerous eggs and raise two or three broods each season. The plumage is brilliant, though occasionally striking, most frequently plain, though very taste-structurally the titmice, aside from their size, are hard to distinguish from the to which birds their habits also ally them any ways. The bill is short and stout, ht and unnotched, and there are no rictal tubs of feathers, directing forward, entirely covering the nostrils. The feet are stout, with late tarsi and short toes. The wing is rounded, with 10 primaries, of which the first is exceedingly short. The tail as long as or longer than the wing is composed of 12 feathers, and usually rounded or graduated. The plumage of the body, long, soft and loose.

Of the 75 species of titmice, one-fifth occur in America all of these having been taken within the limits of the United States. About two-thirds of all the species belong in the genus Parus, and the same proportion holds among our American forms. The most abundant and familiar of our species is the black-capped titmouse (P. atricapillus), widely distributed and known everywhere as the chickadee. The typical form ranges in eastern America from typical form ranges in eastern, but closely allied sub-species, or species, occupy practically all the rest of the Continent. The general color is ash-gray, the back with a brownish tinge, the under parts white, or nearly so; the crown, nape, chin and throat black, with the cheeks white. In size, the various forms range from four and one-half to five and one-half inches, of which the tail is about half. The chickadee is a very active, tireless little bird, returning to the woods and swamps during the summer, but in winter very abundant in our villages and parks and about houses. It can easily be attracted to any spot where food is provided, and if unmolested by cats or otherwise will soon become very familiar. Although it eats bread and crumbs and other articles of a vegetarian's diet, its tastes are carnivorous and it is especially fond of "meat-on-the-bone." When foraging for themselves, chickadees eat an enormous number of insects and thus justify their existence, if that were necessary. As a matter of fact chickadees are so familiar, so daintily clothed, so cheerful even in the severest weather, so courageous, and their usual call note "chick-a-dee-dee," is so pleasing, none of our birds is more universally loved and enjoyed. In the spring, when the mating begins, the chickadee has another note, a plaintive, though not drawn out, "pee-pee." The nest is a mass of moss, feathers, wool, plant down, etc., placed in a hole in a stump, tree or fence post, usually not far from the ground. The eggs are from five to eight in number in each of the two broods, and are white, spotted with reddish-brown. The chickadee of the South Atlantic States (P. carolinensis) is said to have notes quite different from the northern species. In the southeastern United States, ranging north to New Jersey, but rarely further, is another very abundant titmouse, quite different from the chickadee in both color and form, known as the tufted titmouse (Parus bicolor). It is a gray bird, with a black forehead, and a conspicuous crest, an inch longer than the chickadee and not so attractive. The notes are not so attractive as those of the chickadee and become monotonous; the most common rendering in words is "peto, peto, peto," but it also has other calls. The tufted titmouse is not so familiar or confiding as the chickadee and is distinctly a woodland bird, seldom seen about houses. It is not shy and is readily approached, while the prominent crest makes it easy to recognize. The nesting habits and the eggs are similar to those of the chickadee, but the latter are considerably larger. A tufted titmouse occurring in the valley of the Rio
Grande (Parus atricristatus) is notable for its glossy black crest, while the bridled titmouse (P. columboides) is a related species occurring in the southwestern United States and is remarkable for the very conspicuous black and white markings on the head. Besides several other interesting species of Parus, the southwestern United States is the home of four or five very small titmice, belonging to the genera Psaltriparus and Atricapillus. The former are called "bush-tits" and though very plainly colored with black, brown and plumbeous, their very small size, four inches or even less, and their large, waven, penistle nests, with lateral entrance, make them an interesting group. The gold tit (Atricapillus flaviceps) is of about the same size, but is notable for the rich yellow head, the other upper parts being ashy and lower parts whitish. These little birds build great globular nests of twigs, in the bushes, lining them with down and feathers. The eggs are pale bluish speckled with brown.

Of the tits of the Old World, seven species occur in Great Britain, but one of them, the crested tit (Parus cristatus), is only an accidental visitor. The great tit (P. major) is the largest European species, though only about the size of our tufted titmouse. The general color is yellowish and grey, with white cheeks and black head and throat. The blue tit (P. caeruleus) and the cole tit (P. ater) are the commonest of the English species. The former has the top of the head light blue and a bluish cast to the rest of the plumage. It is the species usually called "tomtit." The azure tit (P. caeruleus) of Siberia, which is sky-blue and white, and the large Japanese tit (P. varius), which is handsomely marked with chestnut, will serve as examples of the more brightly colored titmice. The long-tailed tits of the genus Eptithelius are remarkable not merely for their exceptionally long tails but because they build very elaborate cozy nests, which are purse-shaped and hang free or are attached along one side to the trunk of a tree. The eggs are very numerous, as many as 20 having been found in one nest.

Consult in addition to standard ornithologies, Cones, 'Birds of the Northwest' (Washington 1941); and Birds of the Colorado Valley (Salt Lake 1887), and Evans, A. H., 'Birds' (in 'Cambridge Natural History,' Vol. IX, New York 1900).

TITTLEBAT TITMOUSE, the name of a London shop clerk who figures as the hero of "Ten Thousand a Year," a novel by Samuel Warren (q.v.).

TITULAR BISHOP, an episcopal title in the Roman Catholic Church substituted by Pope Leo XIII for the older one of bishop in partibus infidelium.

TITULAR CHURCH, a name given to the parish churches of Rome, as distinct from the patriarchal churches, which belong to the Pope, and from the oratories. Each titular church is a cardinal priest, has a distinct assignation to it, and a font for baptism in case of necessity.

TITUS, companion and well-loved friend of Saint Paul. He was converted by the apostle (Tit. i, 4), at Antioch 50 or 51 A.D., and in the same year accompanied him to Jerusalem, and was present at that first council recognized Gentile converts as part of the Church, and exempted them from some of the Mosaic ritual (cf. Acts xv. 1-11, Gal. ii, 1-3). Paul soon afterward carried the liberty thus accorded by refusing to Titus, a Greek, to be circumcised (Gal. ii, 14). Titus was subsequently with Paul at Ephesus (56), whence he was sent as mission to the Corinthians, carry the second epistle to that church (vii. 6, 12, 23; xii. 18). When Titus (57 A.D.) he found the apostle in Miletus (2 Cor. vii. 6-22, 13-15). Salutary news that Titus left Crete to affairs of the Church and "ordained every city" (Tit. i, 5). Returning Rome he was dispatched by Paul (60 A.D.)—Dalmatia (2 Tim. iv. 10). Titus ren his work in Crete, and died at an age. See also Titus, Epistle to.

TITUS, Flavius Sabinus V., Roman emperor: b. 40 A.D.; d. Reate, Ist Century. He was the son of Vespasian, and succeeded as emperor in 79 A.D., and was brought up at the court of the Emperor Britannicus, whom he accompanied in in Germany and Britain. Later he was a legion in the war of Vespasian and the Jews, conducting the campaign in Judea in the place of his father, who was to the imperial throne. At the end of the and cruel siege Jerusalem was taken by the of Sept. 70. Titus returned to Rome in 71, he was rewarded with the title of Emperor, given a part in the government of the empire. He early manifested the abilities of a and able ruler and he became the most Roman people. The Colosseum, by Vespasian, was completed under his direction. The public baths named in his honor, institutions for the public benefit were established by him.

TITUS, Epistle to, one of the seven letters of Saint Paul, stated to have been written by Titus, as bishop over the Cretans, from Crete, in Macedonia. It is known as one of the "Pastoral Epistles," because devoted to the subject of pastoral duties. In this epistle Saint Paul describes the bishop ought to be, and applies severe to certain of the Cretans. This, and epistles to Timothy, have been much discussion. See Timothy, Epistles to.

TITUS ANDRONICUS. See ANDRONICUS, The Shakespeare canon preserves a speech to almost total absence of external evidence in the case of 'Andronicus' the tantalizing certainty arises from the existence of a large mass of data. Shakespeare's statement in the tragedy is the double testimony of Mere, who lists 'Titus Andronicus' among his tragedies, and of Hemming and Co. in 1623 included the play in the Folio. On the other hand, there are strong claims to anonymity, and the evidence is not enough in the case of the ... surprising that the publishers ... 1611 quartos should not Shakespeare's then popular.
majority of the best critics have been
his conviction that the marks of
s mind are not evident in the plot,
erize, or the language of this
c is little of the unevenness here
finds in works written by inferior
1 revised by Shakespeare; in versi-
in dramatic power this tragedy is
stent throughout, and it seems much
y as likely work of Kyd or Peele than
ear's. The problem is complicated
es to what may conceivably have
r versions of our play. A drama
is and Vespasia' (Vespasia) was
the first time, 11 April 1592. We
itively determine whether this was
m of 'Titus Andronicus' or, as
the naturally suggests, a quite unrelated
he subject of two historical Roman
Another work, called by Henslowe
Andronicus' or 'Andronicus,' was
stage as a new work in January
the Earl of Sussex's company in
June of the same year by the Lord
and Lord Chamberlain's (the last
' s company). On 6 Feb. 1594, 'A
man History of Titus Andronicus'
d to John Danter, and in the same
play, called 'The Most Lamentable
'ed of Titus Andronicus,' was
Danter for Edward White and
Filleton. The subsequent quarto
1600 and 1611 were printed for
all three were sold at the same
out entering into fuller discussion
icence and of other entries in the
Register, it may be said that the
m to establish the identity of Hens-
tus and Andronicus' with our play
in 1594. (The contrary conclusions
P. Baker, iPublications of Modern
Association 60-76, 1901, have been
by the discovery in 1905 of the
. If we eliminate Henslowe's ear-
; and Vespasia as probably unre-
seems little reason to believe that
m of 'Titus Andronicus' existed in
' s lifetime which differed essentially
we possess. Danter licensed 'Titus
' for publication (6 Feb. 1594) on
ay on which Sussex's company is last
as acting it, and his manuscript,
er the year, would seem to be that
acted. We have no reason to be-
Shakespeare revised any plays either
pany or for Pembroke's company,
tid also to have performed the piece.
of the play in the Shakespeare Un-
us, on the other hand, be that acted
rd Chamberlain's company in June,
ater. Since the differences between
ones, however, are relatively quite un-
(Act III, sc. ii is added in the Folio),
as likely on bibliographical as on
ounds that Shakespeare had no more
dh part in the play.
ec source for 'Titus Andronicus'
discovered. Its relation to two later
's of 'Titus Andronicus' is
en by the Dutch poet Jan Vos (printed
German play of Titus Andronicus
regnant empress (ca. 1620), has been
discussed by H. De W. Fuller (Pub-
lications Modern Language Association 1-65,
1901); but it seems probable that these foreign
works, as well as another German play of
which traces exist, are based upon perversions
of the extant 'Titus Andronicus' text, as dis-
seminated by traveling English actors, and not,
as Fuller argues, upon two hypothetical earlier
English plays. Early 17th century allusions to
'Titus Andronicus,' though not very numerous,
are such as to prove that the play was popular
with the masses of the public. Later, John
Downes, writing of the performances of Sir
William Davenant's company after the Resto-
ration, mentions 'Titus Andronicus' among
several others which being old plays, were
acted but now and then; yet being well per-
formed were very satisfactory to the town.
In 1687 Edward Ravenscroft published an
adaptation 'Titus Andronicus, or the Rape of
Lavinia. Acted at the Theatre Royal,' with
a preface containing some important remarks
concerning the old play. Among the more un-
conventional modern theories regarding the
authorship of 'Titus Andronicus' may be noted
Grosart's argument that it was written by
Greene, 'Englische Studien' (1896); J. M.
Robertson's that it is essentially Peele's 'Did
Shakespeare write Titus Andronicus' (1905),
and an ill-considered recent hypothesis of
H. D. Gray that the play was originally by
Shakespeare, revised by Greene and Peele,
'Fügel Memorial Volume' (1916).
TUCKER BROOKE.

TITUSVILLE, Pa., city in Crawford
County, on Oil Creek and on the Pennsylvania
and the New York Central railroads, 100 miles
north of Pittsburgh and 50 miles south of
Erie, Pa. The city is on a plain which slopes
slightly toward the south and east. The natu-
ral drainage is supplemented by an excellent
system of sewerage. The water is obtained
from artesian wells. The broad streets are
largely paved and tree-lined. Electric trolley
lines traverse the principal streets. The manu-
factoring industries consist of one of the larg-
est iron works in the country, a high grade
steel works, machine shops and foundries, large
oil refineries, paraffine works, la
the American radiator works, large branch of
the Bethlehem Steel Company, chemical works,
plaining mills, specialty works, cutlery
works and an electric light and power plant.
The output consists of iron, car tanks, steam engines
and boilers, forgings, oil well machinery and
fittings, gasoline engines, refined oils, gasoline,
etc. There are large oil fields in the vicinity
and the first well sunk for petroleum was
drilled just outside of the city limits in the
summer of 1859, striking oil on 27 August
of that year. There are three banks consist-
ing of a national bank, a commercial bank and
a trust company. One of the finest banking
buildings in the State was erected in 1918.
Among other public buildings are 12 large edi-
ces and two halls for religious services, a
high school with a four-year course, four
graded public schools and a kindergarten, all
under one superintendent; Saint Joseph's Acad-
emy, kindergarten and parish school. There
is also an excellent library, 'Benson Memo-
rial Library,' an excellent Young Men's
Christian Association and Young Women's
Christian Association and the Titusville Hospi-
TITUSVILLE was first settled in 1796, becoming a borough in 1847 and chartered as a city in 1866. The town was laid out in streets in 1800. It suffered great damage from flood and fire 5 June 1892 which destroyed one-third of the city with a loss of 60 lives. The city owns and operates the waterworks and one of the electric light plants. The government is vested in the mayor and five commissioners, the mayor being elected for four years and the commissioners for two years. The majority of the people are native born, the predominating foreign element consisting of Scandinavians, Irish and Germans. Pop. 8,550.

TIUI, tē-wē’, or TIVI, tē-vē’, Philippines, pueblo, province of Alay: on Laganay Bay, on the northeast coast, 23 miles north by west from the pueblo of Alay. It is the centre of a hemp growing region, and exports hemp by way of Tabaco. It is especially celebrated for its thermal springs of iron and sulphur waters with medicinal properties, which are visited by large numbers of natives. Pop. about 11,000.

TIUMEN, tiō-mēn’, Russia, in Siberia, government of Tobolsk, 120 miles southwest of Tobolsk, on the Tura River. It is an important centre of trade, lying on several commercial routes with good communication. It has a large technical school. Its principal manufactures are leather, soap, candles, carpets, pottery and woollen goods. These articles are exported to China, the Kirghiz steppe, Bokhara and many parts of Siberia. The Tiumen and woven carpets are especially renowned. In Tiumen was located a famous exile prison. Pop. about 35,000.

TIVERTON, R. I., town in Newport County, on Narragansett Bay, near Fall River, Mass., and on the New York, New Haven and Hartford Railroad. There are cotton manufactories and oyster and fishing industries. Pop. 4,032.

TIVOLI, tē-vō-lē, Italy, in the province and district of Rome, on the Teverone or Aniene, 16 miles northeast of the capital. Its position on a rocky height overlooking the river is extremely picturesque. Tivoli commands a fine view of Rome and the Campagna. It contains a fine modern cathedral which contrasts sadly with the other town buildings. Its antiquities are numerous and interesting, and include a temple of the Tiburtine sybil, temple of Vesta, villa of Hadrian, etc. The artificial cascades formed by the Teverone constitute an interesting feature of the landscape and supply power for the electric lighting of Rome, and for various factories. The old Latin name was Tibur, important in the Latin Confederation. It became subject to Rome in 388 B.C. The population of the commune is about 15,000. Consult Baedeker’s ‘Central Italy and Rome.’

TLAPAALAN, the mythical home of the Toltecs, and the land from which came their great culture god, Quetzalcoatl, and to which he returned when his mission on earth was done. See QUETZALCOATL; MEXICO—MYTHOLOGY; CHORTLE.

TLAXCALA, tlāsk-kā-lā, or TLASCALA, Mexico, the smallest state in the republic, situated between the states of Puebla, Hidalgo and Mexico. Area, 1,534 square miles. The capital, TLaxcaLa, located about 60 miles east of Mexico City, was in ancient time a large city, but 1909 population is only 2,800. It has a beautiful palace and a stately house that retains much of their former grandeur. The holy well of Olan, in the suburbs, is covered by a costly imposing sanctuary. The state lies within a plateau region, and its surface is broken by high mountains. The principal occupations are agriculture and the manufacture of textiles. Though iron and silver are found, much of its trade is with the sea. Pop. about 192,000, almost all Indians.

TELEMEN, tē-lēmēn’, Algeria, in the department of Oran, 70 miles southwest of the city of Oran, and 30 miles from the Mediterranean. It is a walled town with nine gates, divided into three sections, namely, the old military establishment, the business section, containing the residences of the population native to the town, and the native section. The town stands on a mountain slope at an elevation of 800 feet, amid olive-groves and vineyards. It has some mosques, Protestant and Catholic churches, and a Jewish synagogue. The tenebre comprise textiles, carpets, and small art objects. Trade is especially with Morocco. It is a historic centre of the mountains, dating from the 13th century. At the height of its prosperity, in the 13th and 14th centuries, it is reputed to have had 125,000 population. Pop. 39,874.

TLINKET, or TLINKIT, a tribe which constitutes a distinct stock known as Kolusiana. They are on the coast and islands of southern Alaska. They were rudely constructed, and their members carried on with neighboring tribes. Trade was carried on extensively. They were treated by their masters with cruelty. They have greatly diminished in numbers, till there now remain but about a large number of them being employed in canning industry.

TO A SKYLARK. Shelley’s ‘Prometheus Unbound’ in 1821. As the poetical男女。 It has been used in generations of women and “selections,” but even so careful handling has not served to tarnish qualities in which it still remains unapproachable. Shelley’s ‘Prometheus Unbound,’ is a spirit not a bird, an aspiration. It is besides the poem has the defects of
TOAD—TOAD-FLAX

The poem pursues the flight and the 
: the bird swiftly up to the blue; four 
: smites liken theark to the poet, to 
: to the low-swooning and to the loath-
g of the bird sings itself in the heart 
: at the end comes the pathos of the 
: and unsatisfied desire never absent from 
: 's nature lyrics. The criticism of almost 
: ry has applied to the 's Home to the 
hich have long since become banal but 
: inevitable: it is melodious, exquisite, 
: ecstatic. As such it is unsurpassed and 
: libly unsurpassable. Wordsworth's 'Sky 
: presents a more human point of view; 
: 'Ode to a Nightingale,' an equally 
: achievement of a different kind.

MARION TUCKER.

AD, an amphibian of the anourous 

Bufoidae or some related family in the 

Arvicolidae, in allusion to the structure of 

ulder girdle. The Bufoidae present the 

ig distinctive features: The tongue is 

veloped, fixed to the front of the mouth, 

: the hind end free. The result of this 

ment is that it can be filleted by means 

opiate muscles with the greatest speed 

cision, and thus serves to make these 

ually toothless animals in the capture of in-

ich adhere to this mucous-coated organ. 

re always absent from the jaws, but may 

ent on the vomer in a few foreign gen-

he hind toes are more or less webbed, 

: toes webless and the ends of the toes 

 her clawed nor furnished with adhesive 

In all cases the vertebrae are prococulus 

: bodies hollowed in front, the 

se processes of the sacrum are ex-

and ribs are absent. This family is an 

re one of about 15 genera and 100 species 

osmopolitan, but is especially well rep-

: in tropical America. The species differ 

rably in habits, most of them being ter-

: burrowers, but some are aquatic, others 

: in the United States, Bufo is the only 

: being represented by 9 or 10 species, 

: which belong to the southwestern 

: and Mexico. The common east-

: Bufo (B. leutinmus) is found in one or 

: it sub-species throughout the eastern 

: and Canada. The familiar 

: and warty of the skin of toads is 

: presence of glands and, especially on 

: to bony deposits. They are chiefly 

: ally and nocturnal, and feed upon in-

: which they destroy large numbers. 

: visit the water in March or April, their 

: season, for the purpose of depositing 

: , which are in long strings and are 

: by the male upon their extrusion. 

: mating season the males are very 

: : night and so pugnacious that they 

: l in another in their encounters, 

: :ment takes place rapidly and the tad-

: : ge is passed in three or four months. 

: ment the young toads leave the water in mul-

: : the popular repugnance to these per-

: : harmless animals has no doubt arisen 

: : their unprepossessing aspect and outward 

: : No venom or poison apparatus of 

: : any kind exists in these creatures; and save 

: : that the secretions of the skin may be of acrid 

: : or irratant nature when brought in contact with 

: : or exposed surfaces, they are utterly harm-

: : less to man. There is a swelling above the 

: : eyes covered with pores and large, three 

: : prominent enlargements behind the eyes which 

: : secrete an acrid fluid, which protects these 

: : animals from the attack of carnivorous mam-

: : mals. They also swell up with air when at-

: : tacked by snakes. When handled, toads fre-

: : quently eject urine from the vent, but the wide-

: : spread belief that the contact of this fluid 

: : with the skin produces warts is utterly un-

: : founded. Toads are extremely tenacious of life 

: : and can exist a long time without food; their 

: : hibernation in mud, cracks and holes has proba-

: : bly given rise to the stories of their being 

: : found in places where they must have existed 

: : for centuries without food and air. These 

: : stories, however, have no foundation in fact, 

: : for Dr. Buckland proved, by direct experi-

: : ment, that no toad can live for two years if deprived 

: : of food and air. Another common belief that 

: : toads are often rained down is probably to be 

: : explained by the fact that great numbers of 

: : young toads frequently leave, during showers of 

: : rain, the vicinity of pools in which their whole 

: : life was spent. Toads are really extremely 

: : interesting animals, and much entertainment 

: : can be derived from their observation.

: : Among foreign toads are the great Bufo 

: : aqua, large enough to fill a quart measure, of 

: : the West Indies and South America; the green 

: : toad (B. viridis) of Europe, noted for its 

: : change of color; the long-tongued toad (Rhi-

: : nophyamus dorsalis) of Mexico, which feeds on 

: : termites; the European fire-toad (Bombinator 

: : igneus), so called from its brilliant red under 

: : parts and belonging to the family Discoglos-

: : sidea; and the remarkable Surinam toads, which 

: : are tongueless and carry the young in little 

: : cavities on the back. The last belongs to the 

: : distinct family Pipidae. The spade-foot toad 

: : (q.v.) and the tree-toads or tree-frogs (q.v.) 

: : belong respectively to the families Scaphiopidae 

: : and Hylidae. Many of the toads have remark-

: : able and interesting breeding habits; four 

: : accounts of which reference must be made to 

: : works of herpetology. Consult Boulenger, E. 

: : G., 'Reptiles and Batrachians' (New York 

: : 1914); Cope, E. D., 'Batrachia of North 

: : America' (Washington 1889); Boulenger, G. 

: : A., 'Tailless Batrachia' (London 1892); Dick-

: :erson, M. C., 'The Frog Book' (New York 

: : 1914); Gadow, 'Amphibia and Reptiles' (New 

: : York and London 1901); Kirkland, 'Habits, 

: : Food and Economic Value of the American 

: : Toad' (in Bull. 6, Hatch Exper. Sta., Amherst, 

: : Mass. 1897); Sampson, 'American Naturalist' 

: : (1900).

TOAD-FLAX, a common roadside weed 

(Linaria linaria) belonging to the family 

Scrophulariaceae. It somewhat resembles a 

snapdragon, but is smooth and has many linear 

leaves, either alternate or opposite and vertic-

illate on the lower portions of the stem, and 

very pale green. The flower is produced by a 

terminal bracted densely flowered raceme. The 

blossoms are pale yellow with a short spur, a 

two-lipped corolla, the lower lip spreading and 

three-lobed, with a base so enlarged as nearly 

to close the throat with an orange-colored
TOADFISH. — TOBACCO

palate. This combination of orange and yellow has given rise to the name "butter-and-eggs." It is also called ramstead. The plant has been naturalized from Europe and is rather pretty, but it is very tenacious and very difficult to eradicate.

A native toad-flax is *L. canadensis*, a slender plant, with blue flowers and with a tendency toward oppositeness. The Kenilworth ivy (*Cymbalaria cymbalaria*) is also called ivyleaved toad-flax and is a glabrous trailing perennial with obovate leaves and bluish flowers. *L. triornithophora*, a European plant, is peculiar for its purple, long-spurred flowers blooming in whorls of three and resembling birds, which has suggested the Latin name *three-birds* toad-flax. The American bastard toad-flax (*Comandra umbellata*) is a delicate, pale green, smooth plant of the sandal-wood family, with greenish white or purplish, campanulate corollas and oblanceolate leaves, quite unlike the *Linaria*. In England *Thesium linophyllum*, with leaves like those of toad-flax, is known by the same name as *Comandra*.

TOADFISH, any fish of the genus *Batrachus*, so called from the large head, wide gape and generally toad-like appearance. The common toad-fish (*B. tau*) is from eight inches to a foot long, light brown marbled with black. There are about 12 species, dwelling principally in tropical and sub-tropical seas.

TOADSTONE, (1) in geology, an old English name for certain amygdaloidal basaltic rocks occurring in Cumberland, England. The name is also applied to a mottled, apparently spherulitic felsite, found near Boston. (2) Fragments of rocks or precious stones, resembling toads either in color or form, also fossils of various kinds, supposed to possess special therapeutic virtues. Such objects were for many centuries highly prized in Europe, being worn as rings or amulets.

TOADSTOOLS, properly fungi of the family *Agaricaeae*, which includes the edible mushrooms. See FUNGI.

TOASPERN, Otto, American artist: b. Brooklyn, N. Y., 20 March 1863. He was graduated at the Royal Academy of Fine Arts, Munich (1889); was the pupil of N. Gysis and P. Natier; and became an instructor in the National Academy of Design, New York. He is best known as an illustrator of *Life; Ladies' Home Journal; Century; Harper's* and several leading European periodicals.

TOAST, originally bread dried or scorched before the fire. In the 16th century it became the fashion in England to add toasted bread to drinks. From this habit the term toast came to be applied to a drink of honor proposed to some person or sentiment during the course or at the conclusion of a meal. The growth of social desire to greatly increased the custom of toasting, and it became common to toast not only the reigning monarchs, the hosts and the flag, but each person of the assembled company, absent friends and numerous distinctive names. The custom to denote not only the drink but the person or sentiment toasted, and in this dual sense the word is used to-day. Toasts are properly drunk standing, and it is the modern custom to have some person present reply to the sentiment proposed in an appropriate speech. (Her's "Book of Days" and Valpy's "Toasting" (1881).)

TOBACCO, the common name for the plants of the genus *Nicotiana* there are a large number of species. The dried leaves of these plants have various ways for smoking, chewing. Originating in America, the use of tobacco has been extended to practically all the world and, indeed, it has come comparatively the most generally used to plants. It appears that the name tobacco from the word *tabacco*, originally the natives of Haiti to designate by them in smoking or taking snuff by the Spaniards as the name of most generally used in smoking: alternative products than true tobacco were tatives in the form of snuff. The properties or narcotic effects of tobacco to its content of nicotine and related substances. The tobacco plant belongs to the Solanaceae and is thus related to potato, eggplant, red pepper and there are some 50 or more species, but only two of these, *N. taba- rustica*, are of economic importance. Indians of western North America held *N. quadriloba* in high esteeming purposes. Also, *N. sylvestris*, *N. tabacum*. This is a growing annual, reaching three to more in height. The leaves are nearly arranged on the stem, very quite varied in size, ovate to oblong, entire or with wavy margin, or sessile and decurrent. The number of colored petals is reduced to three and the flower is globular, secreting a viscid nectar. Stomata occur on both sur-

The inflorescence is a terminal, producing large flowers ranging in deep red through various shades of white, a light pink being the more common. Under favorable conditions, branches also develop from buds on leaf-axils. The calyx is five-lobed, four or five-cleft. The corolla is funnel-shaped with spreading and spreading. The blossom is normally self-fertile, bearing five stamens and six to eight ovules. The stigma is cam- sulate, usually two to four-valved, being a number of pod. The seed is 300,000 to 400,000 in an ounce. In numerous varieties the leading commercial varieties are white, yellow, and various other colors. Some of the leading commercial varieties have distinctive names but they themselves only in instances, however, important.
Tobacco are produced from mixtures of districts designated collectively by the type other than by distinctive varietal names. Notably true of Cuban and Turkish N. rustica is an annual with a much drier stem and large, ovate leaves with the corolla tube of the blossom is cal with rounded lobes and is greenish in color. The seed are about three size of those of tabacum. Rustica is earlier in maturing than is tabacum, grown commercially in America but widely cultivated in India and in certain of Asia Minor and Russia, and to some extent in European countries.

Tobacco was widely used by the 17th century in the New World by the American Indians, as well as by the Spanish and French. The Indians, who had been using tobacco for centuries, introduced it to the Spanish explorers, who then introduced it to Europe. Tobacco became a popular smoke item in Europe, and the first commercial tobacco plantations were established in Virginia in the early 17th century. By the 18th century, tobacco had become a major cash crop in the American colonies, and the tobacco trade became a significant factor in the economy of the United States.

At least four distinct varieties of N. tabacum were grown, viz: (1) A large broad-leaf type; (2) a long narrow-leaf "Ox-tongue" form; (3) a type resembling (2) but with broader leaves; (4) a type with very small leaves. Thus, prior to the settlement of Jamestown, the Spaniards and Portuguese had developed an important trade in tobacco between Europe and the West Indies and South America. John Rolfe began the culture of tobacco at Jamestown in 1612 from seed brought from South America or the West Indies and in 1619 20,000 pounds were shipped to England. The growing of tobacco in Maryland began about 1631 and soon became an important enterprise. These two States have continued to grow tobacco in large quantities up to the present day. The Virginia colonists at first grew the crop on the lower lands of the tribe-water region. As the settlers moved further inland, however, it was found that the more elevated and somewhat heavier soils produced tobacco better suited to trade requirements. The cultivation of tobacco became a serious menace to the welfare of the colonists and an inspection service was established in order to prevent the export of damaged or inferior leaf. Attempts were made also to limit the acreage grown but with indifferent success. It appears that the growers learned at a very early date the influence of the soil and the cultural and curing methods on the character of leaf tobacco produced. Thus, the selection of suitable soils, the proper spacing of the plants in the field, use of certain methods of manuring and following definite practices of topping, "suckering," harvesting and curing came to be recognized in the first few decades of practical culture as being of fundamental importance. In the main, present-day cultural methods, therefore, differ from those of the early colonists in details rather than in fundamental principles. The exports of tobacco from Virginia had reached 18,000,000 pounds in 1700, and about 40,000,000 pounds in 1750 while at the outbreak of the Revolution the combined exports of Virginia and Maryland amounted to 100,000,000 pounds. Prior to the Revolutionary War the production of tobacco in the other colonies was not of much importance, but during the period of the War an enormous expansion in total production in the United States. New centres of production were developed and the crop as a whole became differentiated into a number of distinctive types. After the close of the Revolution pioneer settlers from Virginia and Maryland carried the culture of tobacco into Tennessee, Kentucky, Missouri and Ohio. The tobacco produced in western Kentucky and Tennessee, however, found its way to market through New Orleans while the product of eastern Ohio was sent to Baltimore. Missouri at one time became a leading tobacco-producing State although in recent years the production has fallen off to a nominal figure. During the first quarter of the last century the culture of cigar leaf tobacco began to assume importance in the Connecticut Valley and by the middle of the century the cigar tobacco districts of the Miami Valley of Ohio, the Gadsden area in Florida and the New York areas had become established. Next came the development of the Homestead, Pa., district and, beginning about 1870, the
culture of cigar leaf developed very rapidly in southern Wisconsin. As tobacco culture in Virginia was pushed forward onto the gray lands of the south central border counties and into North Carolina a lighter-textured product was obtained. About 1825 began the use of charcoal in curing which had the effect of further improving the quality of the light-colored leaf and subsequently the charcoal was replaced by a system of flues for leading out the smoke and developing the fire and flue cured leaf in curing. In this manner began the development of the vast bright flue-cured tobacco industry. During the latter part of the century this industry spread into eastern North Carolina and South Carolina. Tobacco culture had been introduced into the Blue Grass region of Kentucky at an early date but the discovery of the White Burley variety in Brown County, Ohio, in 1864 revolutionized the industry in central Kentucky and southern Ohio. The Burley type soon came to be produced in enormous quantities. The outstanding event of the past quarter century in the industry is the development in the central Kansas Valley and in western Florida of the shade-grown cigar wrapper leaf industry, a very smokey leaf and highly specialized agricultural enterprise. Turning to the introduction of tobacco into foreign countries, it appears that the plant was first grown in France in 1556 by André Thevet from seed taken back by him on his return from Brazil. The plant attracted little attention, however, till introduced and exploited at the royal court by Jean Nicot, Ambassador to Portugal, whose name became immortalized in the generic name of tobacco, Nicotiana. Tobacco was also first grown in Portugal and in Spain at about this time, and almost immediately was introduced into England, the Netherlands and Rome. Upon his return to England from Virginia in 1655 Sir Richard Grenville introduced pipe smoking as practised by the Indians. For a full half century after this introduction into Europe tobacco was used almost exclusively as a medicinal agent and it was generally believed to possess wonderful curative properties. During the first half of the 17th century however, industry was station, and a portion of light-colored leaf. Its important characteristic, however, is its ability capacity for absorbing the liquid smoking materials or sauces used in the treatment of the sweetened type of plug chew. For this purpose the Burley has also been extensively used in the preparation of cut-plug smoking and fine-cut cigars and in the production of White Burley is grown chiefly on the third type of tobacco. It is our most important type. In recent years flue-cured leaf has become the world's most important type. In recent years flue-cured leaf has been used extensively in the production of granulated smoking materials or sauces used in the production of cut-plug smoking and fine-cut cigars. The bright flue cured type is probably the most extensively used in the domestic manufacture of cigars. There are three sub-types of cigar tobacco: (1) wrapper leaf used as the outer covering of the cigar; (2) binder leaf for holding the cigar's shape; (3) which makes up the body of the cigar. The leaf is grown chiefly in the Connecticut Valley, Long Island, New Jersey, and Gadsden-Deerfield district of Florida. Binder leaf is produced in New York. The leading centres for the production of filler leaf are in the Smoky Mountains of Pennsylvania, the Miami Valley district and the Onondaga district of New York. A dark fire-cured type is exported and is in fact a being unsuited for domestic manufacture in making snuff and for limited use as a wrapper. This type is grown in the counties of central Virginia, in the Hopkinson and Paducah districts of western Kentucky and Tennessee. Henderson or Newport district of Great Britain is the heaviest consumer of cut-plug smoking and fine-cut smoking materials or sauces used in the production of cut-plug smoking and fine-cut cigars. The bright flue cured type is probably the world's most important type. In recent years flue-cured leaf has been used extensively in the preparation of granulated smoking materials or sauces used in the production of cut-plug smoking and fine-cut cigars. The bright flue cured type is probably the most extensively used in the domestic manufacture of cigars. There are three sub-types of cigar tobacco: (1) wrapper leaf used as the outer covering of the cigar; (2) binder leaf for holding the cigar's shape; (3) which makes up the body of the cigar. The leaf is grown chiefly in the Connecticut Valley, Long Island, New Jersey, and Gadsden-Deerfield district of Florida. Binder leaf is produced in New York. 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and the Green River which produce large
ties of dark air-cured tobacco used both
 moisture manufacture and for export. The
cure tobacco is used for the domestic
acure of twist chewing tobacco and for
called rehandling export trade with South
, the West Indies and Central and South
can countries. The Green and other tobacco
1 for the manufacture of long-cut chew-
d for export to England. The Maryland
ern Ohio tobaccos have been exported
ope for centuries, France and The
lands being the chief purchasers. The
leaf also is used to some extent in
tic manufacture. This tobacco is com-
ly light in body and color, dry and
and has good burning qualities but is
characterless in aroma. In the eastern
district the old piebald or spangled type
been largely replaced in recent years by
Burley. In a few counties in the vicinity
hmond, Va., a dark type of leaf known
-cured is produced although in late
the outlying tobacco-producing area.
ning in direct sunlight has been largely
ed in favor of air-curing. This to-
is used in the manufacture of the flat
 of chewing tobacco. Perique tobacco is
only in Saint James Parish, La., and
al production is not large. This type
es mention because of its distinctive
, due primarily to the unique method of
 employed by the growers. Perique is
 used in the preparation of fancy smok-
iixtures to which it adds aroma. To the
amed domestic types entering into con-
 must be added at least three foreign
of special importance, namely, the Cuban,
tria and Java and the so-called Turkish.
 area of Cuba located in the province
ar del Rio in the vicinity of San
 Martinez is grown the world's finest
leaf, noted for its remarkable aroma.
district is known as the Vuelta de Abo-
 the outlying tobacco-producing territory is
ed as Semi-vuelta. The Bahia and Rio
 districts are the Partidos of Hana-
 and the Remedios of Santa Clara prov-
 Porto Rico, the Bahia district of Brazil
ions of the Philippines also produce to-
northern hemisphere. The tobacco of this
 nth of limestone origin, particularly the Hagerstown
, are chiefly used. Clay loams of the
i series are typical tobacco soils of the
 cigar filler district. The dark fire-cured
 air-cured export and manufacture
bcoss are grown on rather heavy silt and clay
obs usually reddish or brownish in color,
 clay subsoils. Both the kind and the
ity of fertilizer applied to the tobacco crop
 are important. An excess of nitrogen injures
quality of the leaf, especially in the case of
the flue-cured type. At least a part of the
rogen should be derived from organic sources
such as cotton-seed meal or dried blood.
liberal supply of potash in the form of sulfate
 carbonate favors good burning qualities and
uces susceptibility to 'leaf spot diseases.
 Chlorine tends to hinder free combustion in
 the cured tobacco. Only quickly available
 phosphoric acid should be used in
 order to ensure products of the highest
character. This is especially true of leaf
 In Connecticut heavy applications of fertilizers
 furnishing 100 to 150 pounds each of nitrogen,
phosphoric acid and potash per acre are com-
ployed while in Southern districts 20
 to 40 pounds of nitrogen and potash and 40 to
 80 pounds of phosphoric acid per acre are ap-
TOBACCO

plied to the crop. Barn manure, also, is widely used in Northern districts. Liming is less essential for tobacco than for many other crops though possibly beneficial under some conditions. The soil is tilled for tobacco about the same as for corn or cotton. When the flower buds begin to develop, or somewhat later, the plants are toped by breaking off the top of the stalk carrying the flower head and upper leaves, in order to force a better development of the leaves remaining on the plant. Cigar wrapper and binder tobaccos, White Burley and Maryland tobacco are topped high, leaving 16 to 20 leaves on the plant, while the heavy fire-cured type is topped to only 10 to 14 leaves and other types are topped to intermediate heights. The suckers or branches which develop in the axils of the leaf also must be broken off by hand. It is important to harvest the crop at the right stage of maturity. As the leaves ripen they take on a lighter green color and become more or less mottled with light-colored sticks. They also tend to crack when folded between the fingers. There are two methods in general use in harvesting the crop. In the first method the stalk is cut off near the ground and the inverted plants are attached to four-foot sticks either by means of cord or hooks properly spaced on the sticks, or by forcing the stick through the butts of the stalks by means of a removable metal spear head, or, finally, by splitting the stalks from the top near the base and simply placing the plants astride the sticks. Each stick carries six to 10 plants and thus laden the sticks are arranged 6 to 12 inches apart on the tier poles of the barn. In the second method the leaves are plucked from the plant as they ripen, beginning at the bottom and taking two to five leaves at each picking. The field is thus gone over three to five times at intervals of a week or 10 days. The leaves are strung on cord by piercing the base of the midrib with a needle or the cord is merely looped around the basal ends of the leaves. The free ends of the sticks are arranged 6 to 12 feet of a four-foot stick, each stick and cord carrying 20 to 40 leaves. Curing, which must be carried out under proper conditions of temperature and moisture supply, is effected in specially constructed curing barns. Three of these methods are commonly practised, known as air-curing, flue-curing and fire-curing. In all cases the process must be so regulated as to develop the desired properties in the tobacco leaf. In air-curing natural atmospheric conditions are largely depended upon and little or no artificial heat is employed. The barns are comparatively large and are provided with a maximum of ventilation. From three to 12 weeks are required to complete the process of air-curing. This method is applied to all cigar tobaccos, Maryland tobacco, White Burley and the dark manufacturing types. For flue-curing the barns are small in size, tightly constructed and are provided with a system of metal pipes by means of which artificial heat may be freely applied with the smoke from a large oven or several small ovens. The tobacco Heat is applied throughout the curing and the temperature is carefully maintained, beginning with 100°F and ending with 200°F. The whole process is conducted in the sticks to be hung on the floor of the barn, thus allowing the smoke to come in contact with the tobacco, to which it imparts a characteristic odor. The barns should be tightly constructed but should be provided with ventilators. In practice heat is applied until the tobacco has been hanging in the barn for three days and the fire is kept going for only a few days at a time. Any warm per- iod of the air-curing and firing are thus continued till the curing process is completed. After curing in the barn is completed the tobacco leaf is too brittle to handle without breaking except after a period of damp weather or when moisture is applied artificially. Under suitable moisture conditions the leaf becomes pliable so that the crop can be handled in preparation for market. After the leaves have been stripped from the stalks they are separated into various grades according to size, color and other important elements of quality. The number of grades made by the grower ranges from two to 10 or more, according to the type and value of the crop. After the grading is completed the leaves are tied into bunches by securely wrapping a folded leaf around the butt ends of the leaves in the bundle. There are several different methods of marketing the various types of leaf tobacco. In the case of cigar tobaccos, and to a limited extent, the dark air-cured and fire-cured types, the buyer inspects and bargains for the crop on the farm, the grower delivering the tobacco at the buyer's receiving warehouse. In the South and, to an increasing extent, in the Western districts the "loose leaf auction system" prevails. Under this system the various grades of the grower are placed in separate lots on the warehouse floor at market centres and sold at auction on a commission basis. In a third system which has been extensively employed, the tobacco, put up in standard containers, is sold from carefully drawn samples without the buyer having seen the contents of the package until delivery has been effected. The sale is made either by auction or by private bargaining. There are three standard containers in which leaf tobacco is delivered to the manufacturers, namely, the box or case, the bale and the hoghead. Cigar tobaccos are packed in cases and bales and Turkish tobacco, also, is packed in bales, while the bulk of other tobaccos is packed in hogheads. In all cases, after having been packed, the tobacco goes through an important fermentative or aging process which develops the aroma and otherwise improves the quality. In some cases, however, the tobacco is put through a preliminary, more active fermentation in large heaps or bulks before it is packed for storage or transportation. The extent or degree of the fermentation is controlled largely by regulating the moisture contents of the tobacco. The tobacco plant throughout its period of growth is subject to injury by numerous insect pests and parasitic diseases. Among the more important insect enemies are the cutworm, wireworm, flea-beetle, hornworm and budworm. The cutworm is the worst best controlled by rotation of crops and the hornworm and budworm by the use of arsenical insecticides or by hand picking, while no effective remedy has been found for the flea-beetle. The tobacco beetle is a serious pest in all forms of cured leaf and
The production of tobacco in the United States by types for the year 1918 is found in Table III.

TABLE III.—Production OF TOBACCO BY TYPES IN 1918.

<table>
<thead>
<tr>
<th>Type and District</th>
<th>Production (pounds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Cigars:</td>
<td></td>
</tr>
<tr>
<td>New England</td>
<td>52,500,000</td>
</tr>
<tr>
<td>New York</td>
<td>67,000,000</td>
</tr>
<tr>
<td>Pennsylvania</td>
<td>64,750,000</td>
</tr>
<tr>
<td>Ohio-Miami Valley</td>
<td>86,750,000</td>
</tr>
<tr>
<td>Wisconsin</td>
<td>65,100,000</td>
</tr>
<tr>
<td>Georgia and Florida</td>
<td>7,080,000</td>
</tr>
<tr>
<td>II. Chewing, Snuff, and Export:</td>
<td></td>
</tr>
<tr>
<td>Burley</td>
<td>269,100,000</td>
</tr>
<tr>
<td>Padrón</td>
<td>60,000,000</td>
</tr>
<tr>
<td>Henderson or Stemming</td>
<td>83,000,000</td>
</tr>
<tr>
<td>One-sucker</td>
<td>67,760,000</td>
</tr>
<tr>
<td>Clarksville and Hopkinsville</td>
<td>77,000,000</td>
</tr>
<tr>
<td>Virginia sun-cured</td>
<td>11,000,000</td>
</tr>
<tr>
<td>Virginia fire-cured</td>
<td>57,650,000</td>
</tr>
<tr>
<td>Flue-cured, old belt</td>
<td>171,800,000</td>
</tr>
<tr>
<td>Flue-cured, new belt</td>
<td>259,100,000</td>
</tr>
<tr>
<td>Maryland and eastern Ohio export</td>
<td>28,700,000</td>
</tr>
<tr>
<td>Perique-Louisiana</td>
<td>125,000</td>
</tr>
</tbody>
</table>

The present normal production of tobacco in the United States is placed at 1,150,000,000 pounds, grown on 1,400,000 acres and having a farm value of $1,380,000,000. Nearly all of this crop is grown in 15 States. Kentucky produces fully a third of the entire crop and Virginia and North Carolina together produce nearly another third. Lancaster County, Pa., with a production of nearly 40,000,000 pounds, is the largest tobacco-growing county of the United States. The crop as a whole is made up approximately of 28 per cent flue-cured, 25 per cent White Burley and 20 per cent each of cigar leaf and the dark fire-cured export type, the remainder consisting of Maryland export and dark-air-cured manufacturing leaf. Considerable quantities of fine cigar and cigarette leaf tobacco are imported into the United States from foreign countries and shipped in from non-contiguous territory. The imports for 1914 as given in Table IV may be taken as representing approximately the normal pre-war import requirements of the tobacco industry. The war proved a disturbing factor in the tobacco trade and while the demand was greater than ever before it was not reflected in the imports.

TABLE IV.—Imports AND ShipmentS FROM Non-contiguous Territories OF Tobacco FOR THE Year 1914.

<table>
<thead>
<tr>
<th>Import</th>
<th>Quantity</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leaf tobacco: Netherlands (Sumatra and Java)</td>
<td>7,688,514</td>
<td>$9,744,750</td>
</tr>
<tr>
<td>Cuba</td>
<td>25,725,202</td>
<td>14,706,246</td>
</tr>
<tr>
<td>Turkey in Europe</td>
<td>9,564,203</td>
<td>5,210,546</td>
</tr>
<tr>
<td>Turkey in Asia</td>
<td>11,577,199</td>
<td>3,804,066</td>
</tr>
<tr>
<td>Shipment from Porto Rico</td>
<td>6,353,528</td>
<td>2,805,532</td>
</tr>
<tr>
<td>Stem and trimmings</td>
<td>1,975,231</td>
<td>223,416</td>
</tr>
</tbody>
</table>

From the earliest days of the colonies, tobacco has always been an important article of export in the international trade of the United States. For many years Great Britain has been the heaviest foreign purchaser of American tobacco. Statistics for the years 1914 is taken as indicating the normal distribution of our exports of leaf tobacco. The data are shown in detail in Table V.
TABLE V.—EXPORTS OF LEAF TOBACCO FOR THE YEAR 1913.

<table>
<thead>
<tr>
<th>Country</th>
<th>Quantity</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>United Kingdom</td>
<td>175,032</td>
<td>$20,638,282</td>
</tr>
<tr>
<td>France</td>
<td>48,154</td>
<td>4,152,302</td>
</tr>
<tr>
<td>Italy</td>
<td>40,567</td>
<td>5,517,813</td>
</tr>
<tr>
<td>Germany</td>
<td>31,697</td>
<td>3,972,062</td>
</tr>
<tr>
<td>Netherlands</td>
<td>28,997</td>
<td>2,908,392</td>
</tr>
<tr>
<td>Spain</td>
<td>21,384</td>
<td>1,405,988</td>
</tr>
<tr>
<td>Canada</td>
<td>18,975</td>
<td>2,291,268</td>
</tr>
<tr>
<td>China</td>
<td>11,940</td>
<td>2,044,615</td>
</tr>
<tr>
<td>Belgium</td>
<td>11,302</td>
<td>1,358,866</td>
</tr>
<tr>
<td>Japan</td>
<td>5,038</td>
<td>726,561</td>
</tr>
<tr>
<td>All other countries</td>
<td>51,286</td>
<td>6,291,545</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>444,371</strong></td>
<td><strong>$52,937,849</strong></td>
</tr>
</tbody>
</table>

The international trade of the United States in tobacco manufactures, also, is considerable, the chief items being the imports of cigars from the Philippines and Cuba and the exports of cigarettes to Asiatic countries. In 1913 the imports of Manila cigars were, in round numbers, 200,000,000, worth $3,863,000. The normal imports of cigars from Cuba amount from 40,000,000 to 45,000,000 annually, valued at $3,500,000 to $4,000,000. Approximately 175,000,000 cigars are shipped into continental United States each year from Porto Rico and these cigars are valued at about $6,500,000. Nearly 5,000,000,000 cigarettes, having a value of $7,000,000 were exported to China in 1917 and in 1918 the number had increased to some 7,500,000,000, worth over $12,000,000. More than a billion cigarettes, also, are exported annually to the Straits Settlements. Total exports of plug tobacco and smoking tobacco amount to some 5,000,250,000,000 pounds, respectively. Our trade in cigars is of little importance. It remains to consider the quantity of tobacco consumed in domestic. The quantities thus used in the manufacture of cigars, cigarettes, smoking and chewing tobacco and snuff are shown in Table VI. They are based on reports of the Internal Revenue Department, not include the use of leaf tobacco consumed in bonded warehouses. The tobacco consumed in these establishments in 1917 amounted to 18,000,000,000 pounds.

The output of the various factories producing leaf tobacco consumed as set forth in Table VII. In addition to leaf tobacco large quantities of licorice and other materials are used in the manufacture of cigarettes. Figures show more or less of an increase from year to year in the use of cigarettes. In addition to the quantities in Table VII, which are based on reports of the commissioner of internal revenue, the forms of tobacco were manufactured to extent in bonded manufacturing war. There were thus manufactured in 1913, 662,940 cigarettes and 87,654,199 cigars, a total output of 29,907,140,551 cigars, 8,020,264,340 cigars for that year. The indicated total of cigarettes manufactured in 1917 is in excess of 40,000,000,000.

In 1914 there were 13,951 establishments with a capital of $303,840,000, engaged in tobacco manufacture in the United States and wages paid to 195,694 engaged in the industry amounted to $69,944,000. The total value of manufacture was $490,165,000. Manufactured tobacco is an important source of government revenue.


TABLE VI.—LEAF TOBACCO USED IN THE DOMESTIC MANUFACTURE OF CIGARS, CIGARETTES, CHEWING AND SMOKING TOBACCO AND SNUFF.

<table>
<thead>
<tr>
<th>Year</th>
<th>Cigars</th>
<th>Cigarettes</th>
<th>Smoking Tobacco and Snuff</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1915</td>
<td>169,575</td>
<td>333,503</td>
<td>911,854</td>
<td>1,435,932</td>
</tr>
<tr>
<td>1916</td>
<td>159,067</td>
<td>338,234</td>
<td>924,198</td>
<td>1,467,479</td>
</tr>
<tr>
<td>1917</td>
<td>158,757</td>
<td>337,457</td>
<td>904,135</td>
<td>1,400,349</td>
</tr>
<tr>
<td>1918</td>
<td>162,985</td>
<td>358,878</td>
<td>938,833</td>
<td>1,451,696</td>
</tr>
<tr>
<td>1919</td>
<td>149,690</td>
<td>357,450</td>
<td>905,347</td>
<td>1,312,487</td>
</tr>
<tr>
<td>1920</td>
<td>141,116</td>
<td>339,210</td>
<td>890,044</td>
<td>1,371,370</td>
</tr>
<tr>
<td>1921</td>
<td>136,670</td>
<td>327,144</td>
<td>854,325</td>
<td>1,318,139</td>
</tr>
<tr>
<td>1922</td>
<td>130,440</td>
<td>320,665</td>
<td>831,907</td>
<td>1,282,912</td>
</tr>
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</table>

TABLE VII.—PRODUCTION OF CIGARS, CIGARETTES, SNUFF AND TOBACCO.

<table>
<thead>
<tr>
<th>Year</th>
<th>Cigars</th>
<th>Cigarettes</th>
<th>Tobacco</th>
</tr>
</thead>
<tbody>
<tr>
<td>1915</td>
<td>8,527</td>
<td>119,269</td>
<td>179,413</td>
</tr>
<tr>
<td>1916</td>
<td>7,931</td>
<td>105,890</td>
<td>17,365</td>
</tr>
<tr>
<td>1917</td>
<td>7,564</td>
<td>123,295</td>
<td>19,242</td>
</tr>
<tr>
<td>1918</td>
<td>8,248</td>
<td>100,407</td>
<td>19,609</td>
</tr>
<tr>
<td>1919</td>
<td>8,609</td>
<td>116,905</td>
<td>19,387</td>
</tr>
<tr>
<td>1920</td>
<td>11,133</td>
<td>105,809</td>
<td>17,284</td>
</tr>
<tr>
<td>1921</td>
<td>10,048</td>
<td>111,769</td>
<td>18,090</td>
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<tr>
<td>1922</td>
<td>9,299</td>
<td>117,900</td>
<td>17,382</td>
</tr>
<tr>
<td>1923</td>
<td>7,928</td>
<td>134,051</td>
<td>17,852</td>
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<tr>
<td>1924</td>
<td>7,710</td>
<td>98,747</td>
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<td>1925</td>
<td>7,716</td>
<td>119,399</td>
<td>17,598</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Type</th>
<th>Pluck</th>
<th>Twist</th>
<th>Fine-cut</th>
<th>Smocking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>pounds</td>
<td>pounds</td>
<td>pounds</td>
<td>pounds</td>
</tr>
<tr>
<td>1915</td>
<td>179,413</td>
<td>19,242</td>
<td>19,242</td>
<td>179,413</td>
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<td>1916</td>
<td>17,365</td>
<td>19,242</td>
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<tr>
<td>1917</td>
<td>19,242</td>
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</tr>
<tr>
<td>1918</td>
<td>19,609</td>
<td>19,387</td>
<td>19,387</td>
<td>19,609</td>
</tr>
<tr>
<td>1919</td>
<td>18,090</td>
<td>17,284</td>
<td>17,284</td>
<td>18,090</td>
</tr>
<tr>
<td>1920</td>
<td>17,284</td>
<td>17,284</td>
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</tr>
<tr>
<td>1921</td>
<td>18,090</td>
<td>17,284</td>
<td>17,284</td>
<td>18,090</td>
</tr>
<tr>
<td>1922</td>
<td>17,382</td>
<td>17,382</td>
<td>17,382</td>
<td>17,382</td>
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<tr>
<td>1923</td>
<td>17,852</td>
<td>17,852</td>
<td>17,852</td>
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<tr>
<td>1924</td>
<td>18,518</td>
<td>18,518</td>
<td>18,518</td>
<td>18,518</td>
</tr>
<tr>
<td>1925</td>
<td>17,598</td>
<td>17,598</td>
<td>17,598</td>
<td>17,598</td>
</tr>
</tbody>
</table>

Wightman W. Garner, Physiologist in Charge of Tobacco Investigations, Bureau of Plant Industry, United States Department of Agriculture.

TOBAGO, tō-bā'gō, British West Indies, an island of the Lesser Antilles, situated 20 miles northeast of Trinidad. It is about 24 miles long by seven miles wide, with an area of 114 square miles. It is hilly, rising at one point to a height of 2,000 feet. The soil is fertile and well cultivated. The chief products are sugar, rum, coconuts, rubber, cacao, cotton and tobacco. The capital and chief port is Scarborough, on the south coast, where steamships to Guiana make stops. The island has been in British possession since 1814 and in 1889 it was united with the colony of Trinidad. Pop. about 21,000.

TOBACCO, a meat sauce made of peppers, originally manufactured in Louisiana by Col. John McIlhenny in 1808.

TOBIKAR, tō-hik-hār'. See Smokho-nean Indians.

TOBIT, Book of, one of the Old Testament books rejected as apocryphal by the Jews and Protestants, but received into the canon by the Roman Catholics. It contains an account of some remarkable events in the life of Tobit, a Jew carried captive to Nineveh, and his son, who is named Tobias. Ewald ascribes the book to a Palestinian Jew who wrote in Hebrew, and suggests as the date of its composition the middle of the 4th century before Christ. The earliest known text is in Greek. See Bible.

TOBOGGAN, a sled-like vehicle, often formed of a single piece of broad flat wood, of birch or balsam, curved up and backward at the front end, and used for sliding down slopes of snow. It is commonly from five to eight feet long, about 15 or 16 inches in width if formed of one piece, or wider if formed of two or more. The curved portion in front is usually fastened by thongs of hide or gut, and the toboggan is strengthened by cross-pieces of hard wood strapped to the body at short distances. Toboggans originated with the Indians, who used them for hauling packs over the snow, and the name is still applied to a class of sleds drawn by dogs. But the toboggan of to-day is chiefly used in the sport of coasting down prepared slides, a popular pastime in Canada and other countries in high latitudes.

TOBOL, tō-bōl', Asia, a river of Siberia, tributary to the Irtysh, which rises in the southern Urals, in Russian central Asia, flows northeast, and after a course of 750 miles empties into the frozen Ob, a tributary of the Yenisei. The river is navigable for more than half its length, but is covered with ice from November to May; its chief affluents are the Uj-Iset, Tura and Tawda. The Trans-Siberian Railway crosses the river at Kurgan.

TOBOLSK, tō-bōlsk', Asia, in Siberia, (1) capital of a government of the same name, on the Irtysh where it joins the Tobol, about 350 miles northwest of Omsk. The principal buildings are the churches, government's residence, bishop's palace, municipal offices, arsenal, barracks, bazaar and hospital; beside the river is a depot for Siberian exiles, assembled from all parts of the country, an episcopal seminary, theatre, gymnasium, etc. The manufactures include bricks, soap and tallow. The trade is unimportant. The town is partly fortified. Pop. 25,200. (2) The government of Tobolsk, in northwestern Siberia, contains an area of 535,739 square miles. The Arctic Ocean borders the northern coast; the principal rivers are the Obi and Irtysh, which are navigable when not frozen over. The chief occupation of the inhabitants is agriculture and cattle-raising; fishing and hunting in the north. Pop. 2,885,700.

TOCANTINS, tō-kän-tēnz', Brazil, a river rising in the southern part of the state of Goiás, and flowing north through Goiás, the Paraná and Paraguay, it emptying into the Atlantic Ocean through the Rio Pará, the southern estuary of the Amazon delta. On the northern boundary of Goiás the river receives from the left the Araguaya, which is considerably larger than the main stream. From the source of the Araguaya in the Cayapo Mountains in Matto Grosso to the Atlantic Ocean is fully 2,200 miles, constituting one of the great rivers of the world. The Tocantins is 1,600 miles long, and though interrupted by falls and rapids, it is navigable in stretches aggregating 1,100 miles. Its estuary is 140 miles long, and receives numerous channels from the Amazon, together with which it separates the island of Marajó from the mainland. The country through which these great twin rivers flow is undeveloped, there being not a single important city on the banks, except Pará at the mouth.

TOQUEVILLE, tōk'vīl (Fr. tük'vel), Alexis Charles Henri Clérel de, French statesman and writer: b. Verneuil, 29 July 1805; d. Cannes, 16 April 1859. He was originally destined for the military profession, but exchanged it for that of law. In 1827 he was appointed an assistant magistrate at Versailles. In 1831 he was commissioned by the French government to proceed along with his friend, M. Gustave de Beaumont, to America, and to
investigate and report upon the penitentiary system of the United States. The results of the inquiry were published in 1833 under the title 'Du Système Pénitentiaire aux États-Unis et de son Application en France.' This, however, was only the precursor of the greater and more notable book 'La Démocratie en Amérique' (1835), to which the Montyon prize of the French Academy was awarded in 1836, and which, by 1850, had run through 13 editions. It was the first systematic analysis of democracy as exemplified in the institutions and political relations of the United States, and was translated into the principal European languages. Tocequeville was in 1839 elected to a seat in the Chamber of Deputies, and ranged himself with the opposition. After the Revolution of 1848 he was nominated deputy from the department of La Manche to the National Assembly, where he voted always against the propositions of the ultra-democratic party. In the spring of 1849, he accepted the portfolio of Foreign Affairs, but resigned it the same year, after holding it for five months. After the coup d'état of 2 Dec. 1851, he lived retired from public affairs, and devoted his leisure to the production of 'L'Ancien Régime et la Révolution,' published in 1856. His complete works appeared in 1860-65. Consult Jaquez, 'Alexis de Tocequeville' (1876); 'Souverains d'Alexis de Tocequeville' (1893); and D'Echialat, 'Alexis de Tocequeville et la Démocratie Libérale' (1897).

TOCSIN, a bell sounded with quick strokes for the purpose of attracting attention. The word is derived from the French, and the use of the tocsin as a signal to arouse the people was so common during the French Revolution that the word has come to be proverbially used for any loud sound or call marking the commencement of an important event.

TODAS, or TUDA, a singular race of people inhabiting the upper part of the Neillgherry Hills in southern India. They are pastoral in their habits and possess a queer unwritten language. Their religion is the worship of the sun and of departed spirits. They form a small polyandry in both its forms — the brothers of one family having one common wife, yet receiving the right, at certain seasons, of temporary husbands to the women of the subject villages. They are a tall, well-proportioned and a fine muscular race of men, are dominant over the neighboring tribes and receive from them a "goodoo" or tribute of one-sixth of their crops, the Todars holding aloof from tillage of the soil. They have slowly increased in number since 1858 when a census of 1877 gave a recent estimate placing their number at 750.

TODD, Alpheus, Canadian author and librarian: b. England, 1831; d. Ottawa, Canada, 22 Jan. 1884. He removed with his parents to Canada in 1833; was for some time assistant librarian of the legislative assembly of Upper Canada, and in 1850 he became chief librarian. Upon the Confederation he was appointed to that office with the Dominion Parliament. He was also a writer of high authority on constitutional law and Parliamentary government. Author of 'The Practice and Privileges of the Two Houses at Toronto' (1839); 'Parliamentary Government in England' (2 vols., 1858-69), etc.

TODD, Charles Burr, American author: b. Redding, Conn., 9 Jan. 1849. He received his education in the public schools. For many years he was special writer on the New York Evening Post. In 1895 he was secretary to the commission appointed by New York to publish the early records of New York City. His published works are 'History of the Burr Family in America' (1879); 'History of Redding, Conn.' (1880); 2d ed., 1901; 'Life and Letters of Joel Story of the City of New York' (1895); 'Story of Washington, the National Capital' (1897); 'Lance, Cross and Canoe in the Valley of the Mississippi,' 'Brief History of New York' (1899); 'The True Aaron Burr' (1903); 'The Real Benedict Arnold' (1904); 'In Old Connecticut' (1905); 'In Old Massachusetts' (1907); 'In Old New York' (1907); 'The Washington Crossing Sketch Book' (1914); 'Sketches of the Delaware Valley' (1916).

TODD, David, American astronomer: b. Lake Ridge, N. Y., 19 March 1855. He graduated from Amherst in 1875 where he became professor of astronomy in 1881. From 1882 to 1897 he held a similar post at Smith College. In order to make astronomical observations he has conducted expeditions to Texas in 1878, transit of Venus, Lie Observatory 1882, to Japan in 1887 and again in 1896, to West Africa in 1889-90, to Tripoli, Barbary, in 1900 and 1905, to the Dutch East Indies in 1911, to the Andes of Chile, and Peru in 1908 and to Russia in 1914. He is the author of several textbooks on astronomy, also 'Stars and Telescopes' (1899); 'Lessons in Astronomy' (1902), also articles in magazines and reviews.

TODD, Henry Alfred, American philologist and educator: b. Woodstock, Ill., 13 March 1854. He was graduated at Princeton University in 1876 and later studied at the universities of Paris, Berlin and Madrid, taking his Ph.D. at Johns Hopkins University in 1885. He was professor of Romance languages at Leal Stanford University, not of polyandry in 1883-85; in 1893 he became professor of Romance philology at Columbia University. He was one of the founders of the Romance Review in 1910; was a member of the advisory council of the Simplified Spelling Board; and in 1906 was president of the Modern Language Association of America. He has edited numerous volumes in the Romance languages.

TODD, Mabel (Loomia), American author: b. Cambridge, Mass., 10 Nov. 1858. She edited the 'Poems' (1890-96) and 'Letters' (1894) of Emily Dickinson and a 'Cycle of Sonnets' (1896) by an anonymous author; also Sted's 'Popular Astronomy' (1899). Her original writins include 'Total Eclipses of the Sun' (1894) and 'Corona and Coronet' (1898); 'A Cycle of Sunsets' (1907). The traditional tale of the Ainu aborigines in Kitami province, Japan, appeared in various magazine articles.

TODD'S TAVERN, Engagements at. The Virginia campaign of 1864 began on 4 May by the advance of the Army of the Potomac across the Rapidan, the cavalry divisions of Generals Gregg and J. H. Wilson leading.
crossed the Rapidan at Germania Ford, arched rapidly by Wilderness Tavern to 's Store, from which he sent a recon- nance toward Mine Run, the rest of his n going into bivouac. During the night s ordered by General Meade to advance direction of Great Chalmette, from the heights on the one nt to hold Parker's Store. Just beyond Church Wilson encountered Rosser's ferate cavalry, which was driven back iles, and at noon, as he had heard noth- the approach of Meade's infantry. On m position was threatened, he began to aw to Parker's Store, when he heard that giment left there had been attacked by ferate infantry, and that he was cut off communication with General Meade's in- He determined to withdraw on the pin road, by way of Shady Grove Church, d's Tavern, on the Brock road. Before oly on the road he was attacked in force and followed by cavalry, he he 3 Tod's Tavern by crossing the Po at Corbin's bridge. A part of his com- was cut off, but came in later in the day. approached Todd's Tavern he was re- by Gregg's division, which, by Meade's orry, was 3 at a stand, and sent to assist him, and s cavalry, which was closely following, was driven back by Gregg to Shady Church, about four miles. Sheridan was the left flank of the army, and covering up, while it was grappling with Lee in wildness, and on the 6th had two di- at Todd's Tavern, covering the roads g at this point, where he was attacked at the day by Stuart, who was anxious to Grant's flanks and his wagon train, but his ive attacks were repulsed. Meade, about his left, directed Sheridan to back from Todd's Tavern, closer to the which Sheridan did in the afternoon, e Confederate cavalry occupied Todd's o Grant's movement the wilderness to Spottsylvania Court was the necessity to hold Todd's Tavern, was midway between the two places and direct road connecting them; and on the s 3 by Gregg's division and two s's, dismounted and fighting on foot, d Stuart and, after a sharp and closely ed action, drove him from Todd's, with severe losses on both sides, Fitz- ce's division retreating in the direction Spottsylvania Court House and Wade one southward to Corbin's bridge of Po Sheridan withdrew and encamped, and Merritt's divisions in the open e east of Todd's Tavern. Very in the morning of the 8th Gregg was put tion to guard the roads from the south erritt's division renewed the engagement hugh Lee on the Spottsylvania Court road to open the way for the advance erritt's field troops from Todd's Tavern Court House. Merritt became severely 1, but slowly gained ground until about when he was relieved and Robinson's of Warren's corps took the advance. Ke's Sharp-shin corps, following Warren's Todd's Tavern at 9.30 A.M., and took covering the Brock road, Catharpin and Ixonia roads, and began to intrench, the extreme right of the army. At 11.30 A.M. Gen. N. A. Miles' brigade, with Gregg's cavalry brigade and a battery, moved out on the Catharpin road toward Corbin's bridge, and when half a mile from it one and one-half miles from Todd's Tavern, the head of column was opened upon with artillery from the south side of Po River. Miles formed line, his artillery replied to that of the enemy, there was a skirmish with Wade Hampton's cavalry, which was kept at bay, and at 5.30 P.M., when Miles began to withdraw, he was attacked by Mahone's division of in- fantry and fell back fighting to Todd's Tavern. Consult 'Official Records' (Vol. XXXVI).

E. A. CARMAN.

TODY, or PALM-WINE, a drink made in tropical countries from the sap of various palms, especially when in a fermented state. The word is of Hindustani origin and is generally applied in India to the substance used yeast to leaven bread. In the Malayan Archi- pelago, tody is the sweet juice of the flower sheaths of Arenga saccharifera. In Brazil the majestic buriti, or muricil palm (q.v.), is felled, and cavities are dug in the stem in which to collect the sap, from which a fermented liquor is made. This has led to the use of the name of wine-palm for this tree. The spadix of the useful Nipa frutescens yields tody which is changed into vinegar by one process, into arrack by another and may also be con- verted into a delicious syrup, thick, frothy and clear, with a slightly saline flavor. Sugar is made from this syrup by evaporation. The tody or jaggery-palm (Caryota urens), a palm crowned by drooping bipinnate leaves, with wedge-shaped leaflets, furnishes a similar sap when the flowering stems are cut. This, like that of the nipa, can be boiled down into syrup and will yield a coarse brown sugar known as jaggery or goor. The sap is fermented for the tody and further distilled for arrack. The cocoaanut (Cocos nucifera), the palmyra palm (Borassus flabelliformis), the date (Phalix dactylifera), and the wild date (Phalix sylvestris), all yield toddy in India, the latter being grown extensively in Burmah. Arrack is made of this drink and the sugar extracted from it; it is said that the sap can be induced to flow from the upper portion of the stem for many years. The West Africans make their tody from Raphia vinifera.

The word tody was applied by the Scots to a drink made of whisky and hot water, sweetened. Burns uses the term in 'The Holy Fair.' Whisky and cold water, properly called grog, is also known by this name, Toddy-Cat is the name given in southern India to the palm-civet on account of its alleged fondness for palm-juce.

TOODY-BIRD, a swallow-shrike (Artamus fuscus) of India and Ceylon. It is about seven inches long, of dusky plumage and is most abundant in wooded districts, especially where palm trees abound, more particularly in the Palmyra or toddy palm, from which it takes several of its popular names.

TOODY-CAT, one of the civets (Paradoxurus typhus), common throughout the greater part of India, Ceylon, Burma and the Malayan region, which dwells mainly in the Palmyra or toddy palm-groves. See Toddy.
TODHUNTER, Isaac, English mathematician: b. Rye, 1830; d. Cambridge, 1 March 1884. He was graduated from London University in 1842 and from Saint John's College, Cambridge, in 1848. He was elected a Fellow of his college in 1849 and became a lecturer and tutor. He was elected a fellow of the Royal Society in 1862. Todhunter was a man of high attainments in various branches of learning, but is best known as the author of numerous mathematical textbooks. His most important works are 'Treatise on the Differential Calculus' (1852); 'Analytical Statics' (1853); 'Plane Co-ordinate Geometry' (1855); 'Examples of Analytical Geometry of Three Dimensions' (1858); 'Algebra' (1858); 'Trigonometry' (1859); 'The Theory of Equations' (1861); 'History of the Progress of the Calculus of Variations during the 19th Century' (1862); 'The Laplacean Mathematical Theory of Probability of Pascal and Laplace' (1865); 'History of the Mathematical Theories of Attraction from Newton to Laplace' (1871); 'The Conflict of Studies' (1873); 'Laplace's Functions' (1878); and 'History of the Theory of Elasticity' (ed. Karl Pearson 1886).

TODHUNTER, John, Irish poet and dramatist: b. Dublin, 30 Dec. 1839. He was educated at Trinity College, Dublin, and after studying at Vienna and Paris, practised medicine for some years in his native city. He was professor of English literature at Alexandria College, New York, 1870-74, and later removed to London. He has published among other works 'Laurel and Other Poems' (1876); 'Alcestis' (1879); 'A Study of Shelley' (1880); 'The Banshee and Other Poems' (1888); and several plays, such as 'Helena in Troas' (performed 1886); 'The Prison Flower' (performed 1891); 'A Comedy of Sights' (performed 1894).

TODELEBEN, to-dë-lë-bën, or TOTLEBEN, Franz Eduard Ivanovitch, Count, Russian general: b. Mitau, Courland, 20 May 1815; d. Soden, Germany, 1 July 1884. He studied at the artillery school of engineers at Saint Petersburg, and entered the Russian army during its operations against the Circassians in 1845. Having been recognized as a most able engineer in this campaign, he was sent to the Crimea in 1854, where he distinguished himself while under constant fire from the guns of the enemy in the rapid conversion of the city of Sevastopol into a formidable fortress. For this and other valuable service during the Sevastopol campaign he was promoted to the rank of general. At the close of the Crimean War he retired into private life, where he devoted himself to scientific investigation and to the writing of a history of the war. During the Russo-Turkish War of 1877 he was sent to Plevna, where he compelled the commander, Osman Pasha, to surrender his entire army to the Russians. He was afterward made commander-in-chief of the army at Constantinople. At the end of the Russo-Turkish War he entered political life, and was in his later years governor, first of Odessa, and then of Sevastopol. He published an account of the defense of Sevastopol (French Trans., 'Défense de Sevasto- pol,' 1804); Consult Kinglake, 'The Invasion of the Crimea' (1863-87); Brialmont, 'Le général comte Todeleben' (1884); Krahmer, 'Generaladjutant Graf Todeleben' (1888).

TODMORDEN, tod-môr'den, England, town in Lancashire and Yorkshire, on the Oder, 21 miles northeast of Manchester. The churches of various denominations, town-hall, free library, technical school, etc., are the chief buildings. The industries consist of foundry, machine works and factories for coal-goods. Pop. about 26,000.

TODY, a term applied to a family (Todidae) of birds closely related to the moorhen and kingfishers. They are distinguished by a long flat bill, short and rounded wings and a short and square tail. Only four species are known, all of small size, and inhabitants of tropical America. The green tody (Tody rufa) of Jamaica is about four inches in length and green on the upper parts, the flanks reclad, the throat scarlet and the belly yellow. The bill is red. It frequents the coasts and watercourses, and has the habit of flying-catcher, taking short flights in pursuit of insects and returning to the perch by a direct route in the manner of kingfishers, in holes excavated in banks, and lay three or four white scutellar eggs. Consult Evans, 'Birds' (New York 1900).

TOFT, an old English word denoting a thicket of trees, or a homestead or a pier on which a messuage or home stood. Taken in the second sense it is frequently used in legal papers in conjunction with the word coft, "toft and coft" mean a house and homestead, with the stable aoutholding, the well and an enclosure. Probably from the fact that the house was usually surrounded by trees on the latter meaning of soft, which is present in the modern word tuft, a grove of trees.

TOGA. See Costume.

TOGO, Heihaichiro, Count, Japanese miral: b. Kagoshima, Japan, 1847. He early became known as one of Japan's most promising naval officers and a few years before the annexation of the Hawaiian Islands by the United States, he was sent to Hawaii to command the battleship 'Maine' to protect Japanese who were then complaining of persecution by the government. There he became involved in warfare with United States ship 'Boston' whose captain supported the demand of the Hawaiian government for the surrender of an escaped Japanese prisoner, a threatened to fire upon the 'Maine.' When Togo immediately cleared his ship for action however, the captain of the 'Boston' apologized and withdrew his threat. In 1894 Togo practically began the war with China by firing upon Chinese transports carrying troops with an evidently hostile purpose. On the breaking out of the Russo-Japanese War in 1904 he was appointed commander-in-chief of the Japanese navy and conducted the operations against Tsushima, and the bombardment of that port. He defeated the Russian fleet there, driving it back to the shelter of the Russian inner harbor, and damaging several Russian ships. On 27-28 May 1905 he met and annihilated the Russian Baltic squadron, only to small cruisers and some torpedo boats esc.
GOLAND, Africa, a territory on the f Guinea, between French Dahomey and its Gold Coast, held as a German col-

umn 1894 to 7 Aug. 1914, when it was oc-

cupied by British and French troops. Ac-

tween Germany in 1913 was over 100. It has a coast line of 32 miles, but 325 miles inland, where it becomes r. Area, 33,630 square miles. Lome is ef port and capital. The coast is low

order by lagoons, but the interior is

by the escarpment of the Sudan Pla-

The country is well watered, the interior

ches of the Volta, which forms the west

ry. The chief products are palm oil,

rubber, indigo and dye-woods. Cattle

is carried on by many of the natives.

also do weaving, make pottery and mine

nothing but a little iron. The inhabitants, who are about 2,000,000, are ethnic negroes, the

anterior population being less than 400.

ce is rapidly increasing, and there is

steamship connection with Europe.

GUE, a local name in Maine for the

ot (q.v.).

ILERS OF THE SEA ("Les Travail-

le la Mer"), a novel by Victor Hugo,
ed in 1856. The scene is laid in the 13th, and the book is dedicated to

de of Guernsey, severe yet gentle, my

asylum, my probable tomb."

ISE, toiz, in the French system of mea-
sed previous to the decimal system, was
t of linear dimension. It consisted of six

feet, each of which was composed of

ces or inches, each pouce being divided

lignes or lines. The toise was thus the

ent of 1.94904 + metres or of 6.3946 +

feet.

KAT, tóká’t, Asia Minor, a town in

yet of Sivas, 70 miles from the Black

textures between steep rocky walls in a th

of narrow streets bordered by miser-

ess. It contains a large mosque, ba-

foundries and manufactories of carpets,

ool and cotton goods, etc. Copper is

in the vicinity. The town was formerly

ous, but ill treatment of the Armenian

ion has largely reduced its inhabitants,

l to number about 22,000 in 1919.

KAY, tóká’ (Hungarian, tókoi), Hun-

a Semplin County, at the junction of the

an Bodrog, 130 miles northeast of

buildings include a theological semi-

corium, high school, etc. In the or-

hood are rich mineral deposits, as salt,

es, etc. The chief occupations are agricul-

ture, viticulture and timber trade.

ay wine is famous, and the best is pro-

on the hill of Mezés-Máli. Great care

cised in the culture, gathering and selec-

t the grapes. The wine is of various

es, dependent finally upon the amount or

artificial pressure. The best kinds are

ce and the Ausbruch, of amber color

every year about 1,300 varieties are pro-

es, grouped as sweet and dry; 2,000,000

are produced, but the celebrity of the

such that many imitations are made by

French and German dealers, which are even

sold in Hungary. Pop. 5,500.

TOKEN MONEY, a name in numismatics

plied to pieces of money current only by

suffrance and not coined by the authority of

state or governors in England. In the late 16th century the national coinage was so

satisfactory and inconvenient that large num-

bers of private traders and merchants were im-

elled to have halfpence and farthings manu-

factured for themselves. These "tokens" they were called, were made of lead, pewter,

latten, tin and even leather, and could only be

made of as currency at the shops or ware-

houses of their respective issuers. Notwith-

standing the endeavors made during several

regains to put a stop to the circulation of this

unauthorized coinage, traders' tokens continued to multiply to an astonishing extent, until, in

1672, a proclamation was issued, prohibiting their making or use under severe penalties. From that date until 1787 the issue of private

tokens entirely ceased; but in the latter year,

owing to the great scarcity of government cop-

coins, the Anglesey Copper Mines Company

and put into circulation some 300 tons of copper pence and halfpence. The boldness of this

ample thus set was speedily followed by other

trading firms all over the kingdom, and again

the government found it necessary to take action

in the matter, which it did by issuing a new na-

tional copper coinage. For some years the issue of private tokens was thus effectually checked;

but in 1811 the authorized coinage again getting

scarce, the copper companies and others recom-

mended the issue of batches of tokens. This

went on until 27 July 1817, when the manu-

facture was prohibited by act of Parliament,

and all the tokens in currency ordered to be with-

drawn from circulation by 1 Jan. 1818.

In the United States small coins became so

scarce in 1862 that tokens made their appearance in large quantities. They were of two

classes, war or patriotic tokens, and trade or advertisement tokens. Both kinds were issued

with a mercantile or home, since they passed for a cent and could be manufactured (in sufficient

quantities) for much less. Such tariffs and tokens appeared during 1862, 1863 and 1864. Of

the patriotic or war tokens there were something like 400 varieties coined, including mulings

and different metals, the latter largely restrikes. Of

original pairs of obverse and reverse there must

have been less than 200. The common varieties bore the inscriptions "Army and Navy,"

and "Not One Cent." The first coinage of trade

tokens, or store cards, as they were sometimes

called, took place in Cincinnati where nearly 900

varieties were issued, fully three times as many

varieties as any other city issued except New

York. A number of other Western cities soon

followed the example of Cincinnati, but it was

not until the early part of 1863 that New York

began to issue the famous Lindenmuller cents,

of which there were more than a million

coined; these were followed by the Knicker-

bocker tokens, consisting of many varieties.

Altogether there were between 700 and 700

varieties issued from New York. Ohio issued

about 1,300 varieties from 100 different cities

and towns, more than any other State issued;

New York State comes next after Ohio, with

over 900 varieties. New Jersey had but few,
and Pennsylvania not many; chiefly from Philadelphia and Pittsburgh. Detroit furnished as many advertisers as New York, and the rest of Michigan nearly as many as Cincinnati. Indiana had about 100, Illinois, including Chicago, not as many as Indiana; and Wisconsin nearly twice as many. When the government stopped the coining of tokens in 1864 there were upward of 20,000,000 in circulation.

TOKIO, トキョー, or TOKYO, the capital of Japan, situated at the head of the land-locked Bay of Tokio, on the east coast of central Honshu, and at the mouth of the Sumida Gawa. Besides the latter river, which divides the city into two unequal parts, Tokio is intersected by a large number of canals, which are generally crossed by wooden bridges. Some of the canals form concentric courses, enclosing a number of islands, one within the other; and on the innermost of these stands the imperial palace. This large cluster of buildings is surrounded by magnificent gardens, and enclosed by high walls and towers. The outer islands are most of the government departments and foreign legations. Surrounding these central islands, the city spreads out on all sides, with a rather irregular and complex street plan. There are numerous parks in and around the city, some of them being large and beautiful. Practically all the houses are built of wood. Besides the palace the only notable buildings are some of the numerous temples, especially that of Kanonji, and the temple of the Shoguns. There are six European churches, the finest being the Russian cathedral. Tokio contains about 70 hospitals of good standing, including the Komagome Hospital for epidemics and the Tokio Charity Hospital. The former is supported by the city and the latter by the imperial Court. There also exists an asylum for orphans of the poor, established by the city. According to the latest returns on educational affairs there are about 500 public and private primary schools and kindergartens. The number of children of school age is about 225,000 of whom about 80 per cent are in attendance. There are 35 middle schools, public and private, of which six are for girls. The schools have no religious instruction given under the direct control of the Department of Education number 13, including the Imperial University, the First High School, the Higher Commercial School, School of Foreign Languages, the Tokio Higher Technical School, Higher Male Normal School and Higher Female Normal School. Besides there are two public normal schools, supported by the Tokio Prefecture. The keigakukai, Waseda and Women's University are most prominent among the private high class institutions, among which are included 10 other colleges of law, economics, philosophy and religion. In addition to those above mentioned, there are over 280 public and private schools, mostly of the middle school grade, teaching special subjects. The city has a number of libraries opened to the public, including the Imperial Library at Uyeno Park. The sanitary condition of the city is in a fair condition, though street drainage is not so well advanced as in Western countries. Each ku (ward) has a sanitary section supported by rate levies from the inhabitants thereto. The metropolis is well supplied with parks and open spaces. The largest parks are Uyeno and Hibiya parks. In the first two, beautiful temples connected with the kugawa family, and here the remains of Shoguns are buried. At Uyeno the Imperial Museum. Automobiles have been introduced as a means of transportati "autobus" line is in operation, in 1920 the electric tramways. Streets are not regularly laid out, but new buildings are being erected. Great harbor have been undertaken by the municipal Corporation at a cost of 37,000,000 yen. There is modern water-supply system, excellent railways, gas and electric light, mac roads, public works, etc., all carried on ing to methods of civilized cities all over world. The municipal council is elected by the city and county, and the latter is the popular vote. Although the prime centre of the empire, Tokio is no dispensary manufacturing or commercial city. It is Yokohama, near the entrance to the city was founded in 1450 and became the capital of the Shoguns residing at Kioto. The center of the Shoguns in 1868, Tokio (still known as Yedo) became the residence of the and the sole capital. It has several suffered from earthquakes and fires. Popp. 2,244,796.

TÖKÖLY, 토케리, or TÖKELY, 토끼, COUN, Hungarian patriot. See The University of Budapest.

TOKUGAWA, Prince, Japanese statesman and political leader, known as "father of the Tycoonos." See Hiroro Kasaishi.

TOKUSHIMA, 토쿠슈마, or TÖKUSIMA, TÖ-ko-so-shi, Japan, capital of the prefecture of the same name, the largest city on the island of Shikoku, situated on the northeast coast, on the Kumano. It is an important steamship station, and a picturesque location on the coast and contain background. Pop. 70,000. The metropolitan population is 775,000.

TOLAND, John, English writer, London, 30 Nov. 1670; d. 1722. He was brought up as a Catholic, but read under the influence of Protestantism. He was educated at the University of Glasgow, and studied divinity in the University of Leyden. In 1696 he published a work entitled "Christianity not Mysterious," which was regarded as opening the door to controversy between deism and orthodox. The House of Commons ordered it to be burnt, the common hangman, and Toland then determined opposition from many. Though Locke gave him a certain support. He subsequently supported in literary hack-work and various for political party service. Besides the work mentioned he wrote a "Life of Milton" in an edition of his prose works: 1. "Hucul, Lord Holder" (1699); 2. "Anglia," a defense of the Act of Secrecy and "The State Anatomy of Great etc. (1717).

TOLEDO, 토레도, Ohio, city, seat of Tama County, on the Chicago, North Rail Road, about 50 miles north of Cleveland, and three miles west of the railroad junction on the Iron.
settled in 1844. It is in a fertile agricultural region in which there is considerable attention given to stock-raising. The industries are connected chiefly with the farm products. The principal public buildings are the county courthouse, jail, the churches and schools. The Emma Willard School is a High School and the Vermilion High School are the leading institutions besides a collegiate weekly. The government is administered by a mayor and a council composed of six members. Pop. 1,721.

TOLEDO, Ohio, city, county-seat of Lucas County, on the Maumee River, near its mouth; lat. 41° 30' N., long. 83° 32' W. The city is 587 feet above sea-level. It is 96 miles west of Cleveland, 124 miles north of Columbus and 234 miles east of Chicago. The northern corporation line is within two miles of the Michigan boundary. The city lies on both sides of the Maumee River, the principal business section being on the left bank; it extends from the river mouth, where the stream opens into Maumee Bay, over nine miles up stream. The area of the city is 31.59 square miles.

Commerce and Transportation.—The location of Toledo, at the western end of Lake Erie, gives it great commercial advantages, for it is at the head of the direct lake route eastward. The distance by lake to Chicago is 691 miles, while it is but 234 miles by rail. Hence there is an enormous traffic between the Eastern cities and the region lying southwestward, of which Toledo is the distributing point. The natural advantage is supplemented by the railroad system, the city being the centre of 16 trunk lines, making direct communication to the Atlantic on the east and the Pacific on the west, with direct lines north and south. These trunk lines, including their branches, give a grand total of 23, making Toledo second only to Chicago in the number of railroads; 393 trains and 572 interurbans arrive and depart every 24 hours. Many of the trunk roads reaching the city have dock facilities, with regular steamer connections to all important lake ports.

The location of Toledo makes it the most convenient shipping point for a large portion of the “winter-wheat belt,” and it is one of the markets of many grains produced in the United States, after Chicago. It has 12 grain elevators, with a storage capacity of 8,500,000 bushels. Toledo is the leading clover-seed market of the world and its quotations govern the prices of clover-seed for the United States. In 1918 Toledo received over 20,000,000 bushels of wheat, corn, rye, oats and barley. Toledo is one of the largest shipping ports for soft coal in the world. This comes by rail from the mines of West Virginia, southern and eastern Ohio and Pennsylvania, and is transported by water to all ports on the upper lakes. The Ohio Central, Hocking Valley, Pennsylvania and Baltimore and Ohio railroads have immense docks on the river front, with steam apparatus by which a carload of coal or a ton of iron ore is conveyed into the hold of a vessel. Similar appliances are used for the rapid unloading of iron ore coming from the Lake Superior mines, which is shipped by the same roads to the iron furnaces in southern Ohio. The city has, thus, producing a superior quality of iron and steel. There is also a very large trade done in lumber, salt, etc., Toledo being the largest distributing point on the lakes for coal, ore and lumber. More than 50 per cent of all the coal transported on the Great Lakes in 1918 was loaded in Toledo.

The harbor of Toledo lies entirely within the Maumee River, giving full protection to shipping. The Maumee is really a wide and deep estuary of Lake Erie, to the foot of the historic “Rapids of the Maumee,” just above Perrysburg, the site of Fort Meigs, famed for Harrison’s defense in 1813. Above this the river passes for some 15 miles over outcrops of limestone. At the northern city line the river opens into Maumee Bay, which is three miles wide and south by six miles east and west. Through the bay the United States government has dredged a straight channel, 400 feet wide by 21 feet deep and eight miles long from the mouth of the river. The harbor proper embraces the wide channel of the river, which is from 1700 to 1400 feet wide between the two points established by the government. The channel of the stream has been improved by the government to the same depth and width as the straight channel. The cost of this channel through the bay, and the necessary railway improvements, has been over $2,000,000. The wharfage space covers both banks of the river the entire length of the city, 18 miles in all, besides several miles on Swan Creek, a deep tributary which enters the river in the middle of the business section. Besides these there is an unlimited wharf capacity along the shores of the bay, now being utilized.

Manufactures.—The advantages of Toledo as a distributing point by lake and rail, its proximity to raw material and fuel, have caused its industrial interests to dominate all others. As an example of this is the fact that the renowned Lake Superior iron ores and the coal and coke from the Ohio and West Virginia fields meet at its wharves on a common basis of economy. This resulted in the building in 1903 and 1904 of a blast furnace and steel plant on the river front by the Toledo Furnace Company with a capacity of 400 tons per day. This company is now capitalized at $4,000,000 and its capacity has been doubled. Other great industrial establishments nationally known and with large capital invested in Toledo are the Willys-Overland Company, $75,000,000, producing passenger automobiles. This is the second largest automobile plant in the world; the Paragon Refining Company, $25,000,000, which refines petroleum; the Owens Bottle Machine Company, $15,500,000, producers of the bottle-making machine, which has revolutionized that industry; National Supply Company, $14,000,000, producing oil well supplies and machinery; the Electric Auto-Lite Company, $13,000,000, producing automobile starting and lighting systems; the National Malleable Castings Company, $8,000,000, with the largest malleable casting plant in the world; the Sun Company, $8,000,000, refiners of petroleum; the Detroit Machine and Tool Company, $3,000,000, builders of presses and machine tools; the Towar Textile Mills Corporation, $2,500,000, producing heavy ducking and belting; the Champion Spark Plug Company, $2,000,000, produces more than 50 per cent of all the spark plugs in the world.
the Ed. Ford Plate Glass Company, $2,000,000, manufacturers of polished plate glass; the Toledo Shipbuilding Company, $2,000,000, which has built some of the largest ships on the Great Lakes; the Ohio Superphosphate Company, $1,000,000, manufacturers of fine cut glassware and electric light bulbs; the Hettrick Manufacturing Company, $1,000,000, manufacturers of tents, awnings and canvas goods; the Toledo Sugar Company, $1,000,000, which refines sugar from beets extensively cultivated in the territory surrounding Toledo; the Toledo Scale Company, $900,000, manufacturers of the famous Toledo scale; Milburn Wagon Company, $700,000, builders of farm wagons and electric vehicles. There are more than 600 other busy manufacturing plants in Toledo; in the Manufacturing Directory, issued by the Toledo Commerce Club, there are 921 different classifications of articles made in Toledo. Toledo is the centre of the midwest, and it has six railroads, the Toledo and Detroit, the Toledo and Buffalo, the Western Maryland, the Toledo and Chicago, the Toledo and Chicago Electric. There are four plants in Toledo capitalized at $1,250,000, producing bicycles and children's vehicles and giving employment to more than 1,000 men. More than 60,000 people are employed in the industries of Toledo. Most of the oil and gas in the oil field is supplied by the Toledo Railway and Light Company. The Acme Power Company, a subsidiary company of the Railways and Light Company, has completed the first unit of an $8,000,000 plant, which will be utilized to further electrify Toledo's industries. The Standard Oil Company of Ohio has erected a $5,000,000 refinery. This company has a pipe line direct to the mid-continent field, through which the crude oil is pumped. The $20,000,000 nitrate plant started by the government in 1918 in Toledo is to be converted into a permanent arsenal. Toledo is one of the busiest wholesaling and jobbing centres in the Middle West. The many railroads and electric lines make shipping easy to any territory surrounding the city. Post office records show that 42,000,000 people can be reached with overnight mail service. Large manufacturers in the East and West maintain branch houses and distributing stations in Toledo.

Banks.—There are four national banks and 18 State savings and private banks in Toledo. The capital of the national banks is $3,500,000, and the surplus and undivided profits of these banks amount to $4,499,382. The capital of the other 18 banks totals $8,140,300, with surplus and undivided profits of $2,366,619. In addition to these banks there are eight building and loan companies with a combined capital stock of $20,700,000. At the beginning of 1918 the bank deposits in Toledo were $100,000,000; clearings during 1918 totaled $539,114,586. Toledo also is home of nine bond houses, which do business upwards of $85,000,000 annually. In 1918 Toledo lead all cities of its class in postal savants deposits. Records show there were 2,950 individual depositors and $1,318,173 on deposit. The post-office receipts in Toledo in 1918 totaled $1,391,000.

Municipal Conditions.—The slope from the lake on both sides is gradual, but ample drainage is sufficient to ensure good drainage. It is well laid out, with wide streets. These aggregate 425 miles in length, of which 400 miles are sidewalked, 256 miles electrically lighted and 24 miles are paved, chiefly with wood block, brick and asphalt. The residence streets are beautifully shaded, and the absence of all fencing, it is said, gives this city a distinctive appearance. The sewage system is excellent, there being a total of 292 miles, all emptying into the Maumee River. The waterworks originally cost about $1,400,000 and has a capacity of 70,000,000 gallons daily, with 350 miles of street mains. The city is supplied with natural gas brought from three fields, northwestern Ohio, central Ohio and West Virginia; and there are 25,000 consumers, the gas being used only for household purposes. The electric car system is very complete, covering 120 miles of streets and accommodating all sections of the city. There are 10 distinct interurban electric roads in addition, with freight and passenger stations in the business centre. They have a total of 1,546 miles of track, the United States having a large number of surrounding cities and villages, including Cleveland and Detroit. The discovery of gas and petroleum in northwestern Ohio in 1886 was one of the contributing causes for the growth of Toledo, as this city is the natural metropolis of two United States, and this business remains a potent factor. The rapid growth in population caused the expansion of the residence section in Toledo. In the west end of the city, which was the newer area, there are thousands of beautiful homes set among the original forest trees. In more recent years beautiful residential sections have been developed by real estate operators. Ottawa Hills is one of the most beautiful high-class residential developments in the country. Many large homes have been built in the up-river section. Toledo has a greater per cent of home-owners than any city of its size in the country. The working man owns his modest home and takes pride in his lawns and garden patch. All of the residential streets are well paved and lighted with 3,160 arc lamps.

Buildings.—Among the notable buildings are the courthouse, in front of which is a life-size bronze statue of President McKinley, erected in 1903; the Museum of Art; the Christian Association building; the Masonic temple; the Young Woman's Christian Association building; Newsboys' building; the City Market; the Terminal Auditorium, which will seat 5,000 persons; handsome Temple and Social Club building; Woman's building; a Soldiers' Memorial building; arms of the Ohio National Guard; the Public Library (which has 50,000 volumes and five sub-stations); the Valentine Theatre, one of the finest and most artistic interiors in the United States, and many modern office and business blocks.

Churches and Schools.—There are 45 church edifices in the city, nearly all having Sunday-schools. Some of the rooms devoted to the latter are up to the best modern standards in plan and equipment. Nearly all have large libraries for the use of the scholars. There are two public high schools, built at a cost of $125,000 each, a manual training school and a vocational high school. There are 51 public school buildings, 50 public schools belonging to and controlled by the Roman Catholic Church. The latter Church also supports an academy under the Ursuline Nuns.
TOLEDO

ar school by the Notre Dame Sisters, and
ohn's College, an institution for boys and
en, under the direction of the Order of
es, 10 students is maintained by the city.
 two large business houses, none of which has 500
useum of Art is an organization for the
ent of art, numbering in its member-
eae progressive citizens. It occupies
ing at a cost of $1,000,000 and a va-
collections of paintings and objects of art.
bea. Without the beneficent and phil-
stitutions are the Toledo State Hos-
 the Insane, supported by the State.
 the cottage plan, with accommodations for
 students; the Toledo al, a large institution supported by the
try contributions of citizens; Saint Vin-
 Hospital and Saint Anthony's Orphans' con-
 the Gray Nuns; Lutheran is' Home; Old Ladies' Home; a Roman
ic for the aged, conducted by the Sisters of the Poor; Mercy Hospital;
ood Hospital; Flower Hospital; Mater-
ospital; the Country Children's Home;
 Men's Christian Association and
Woman's Christian Association; the day
, a home for foundlings, training school
ness; and a number of private hospitals.
ks.—The park system of Toledo em-
a total of 1,532 acres; beginning at the
its the river on the west side is
ge Park, 64 acres, on a bluff 75 feet
 an unrivalled river view; Ottawa
 on the western side of the city, 280
 Willys Park, 100 acres; Bay View
 202 acres, at the point where the river
 into the bay. Further up the river on
le is Riverside Park, 63 acres, fronting
. On the east side are Collier Park,
, and Navarre Park, 62 acres. Besides
 are 44 smaller parks and triangular
 ranging from one-eighth of an acre to
 acres area. The large parks are con-
 by a boulevard, which is 10 miles long
 side, 150 to 200 feet wide, now
 construction, extending in a semi-circle
Valbridge to Bay View parks, the most
 necessary land being donated by property-
. On the east side a similar semi-circle
ed and partially completed. Recreation-
ality and parks are being increased in-
 as rapidly as the city budget permits.
 creation.—Toledo offers all the advan-
 of a summer resort, because of its proxi-
 Lake Erie and its fine beaches. Just 45
 s from the heart of the city is located
Beach. Here will be found many com-
 summer homes along the edge of Lake
xtending for a distance of several miles.
eds of Toledo people spend the summer
 at the beach, going to and from work
. The street cars run to the beach every half hour to service this resort. Point Place
tewater, located on the bay just outside
 limits, are meccas for fishermen. On
h shore of Maumee Bay will be found
 View Beach, with many cozy summer
estled among the groves which border
shore. In the city Walbridge, Riverside
y View parks are located on the banks
 Maumee River. These are easy of access
and daily, during the summer time, attract thou-
ousands of people. Yachting and boating are
favorite sports in Toledo. The river and bay
 are dotted with small crafts of all kinds. More
 than $5,000,000 has been invested by the people
 of Toledo in sailboats, motorboats, canoes and
 cruising yachts. There are three yacht clubs
 and a power boat club. The city maintains one of the finest buildings of its kind
 in the country at the mouth of the Maumee
 River. This club adjoins Bay View Park. The
 Toledo Power Boat Club is situated on
 the bay near Bay View Park. The Maumee
 River Yacht Club has headquarters on Ottawa River near the
 bay. The city maintains a municipal club
 house at Riverside Park. There are many
 other smaller club houses supported by canoe
 clubs, etc. In the winter time ice boating
 and skating are the leading outdoor sports. Prac-
tically all of Toledo's parks have public swim-
ming pools and the most modern playgrounds
 equipped for the children. In Ottawa Park
 there is one of the finest municipal golf courses
 in the United States. Public tennis courts also
 are maintained by the city. Fine golf courses
 are maintained by the Inverness Club, Country
 Club, South Shore Country Club and the Sylvan
ia Golf Club. There is a keen interest in
 Toledo in baseball. Toledo supports a team in
 the American Association, and Swayne Field,
 the home of the Toledo team, is one of the
 finest ball parks in the league. There are many
 semi-professional teams which have large fol-
 lowings. The city maintains ball diamonds
 in several of its parks. Toledo is a Mecca for
 excursions during the summer months; people
 come for hundreds of miles to take trips on the
 water. Three passenger steamship lines main-
tain regular service to Sugar Island, Detroit,
 Mackinac, Put-in-Bay, Cedar Point, Cleveland,
 Buffalo and other points on the Great Lakes.

Government.—Toledo has a simplified
 form of the Federal form of government. The
 people elect the mayor, vice-mayor and one
 ward councilman. All other city officers are
 appointed by the mayor, with the exception of
 the city clerk, who is elected by the council. All
 city offices are for a term of two years. There
 are 16 wards. The vice-mayor presides over
 council, but has no vote except in case of a
 tie. The mayor's cabinet, appointed by him,
 consists of the heads of various city depart-
ments; these are a director of law, director of
 public service, director of public safety, director
 of public welfare, director of finance.

History.—The Maumee River was one of
 the most important routes for travel by the
 Indians and the white traders. Going by canoe
 to a point near Fort Wayne, Ind., a portage of
 a few miles enabled them to reach the head-
 waters of the Wabash, which they followed to
 the Ohio and thence to the Mississippi. An-
 other important route passed down the Auglaize, a southern tributary, thence by
 portage to the headwaters of the Great Miami,
 which reaches the Ohio just below Cincinnati.
 An important Indian trail also crossed the river
 at the rapids above the city, by which hunting
 parties went to Kentucky. A few French Can-
 adian hunters and trappers settled, in the 18th
 century, at points within the present site of
 Toledo; but there is no reliable account of the

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earliest sporadic settlement of Americans on the city plat. In 1805 a treaty was made between the United States and the Indians, at a stockade, named Fort Necessity, which stood on a high clay bluff at the junction of Swan Creek and the Maumee. By this the red men yielded title to the "Fire Lands," granted to the citizens of Groton and New London, Conn., in recompense for the burnings of these towns by the British in the Revolution. In 1817 a company of speculators laid out a town at the mouth of Swan Creek, called Port Lawrence. Very few settlers came, however, and the hamlet languished. In 1832 another settlement, named Vistula, was begun by Major Stickney, for many years Indian agent, a mile further down the river, at the foot of what is now Lagrange street. This spurred the owners of the land at Port Lawrence to new efforts, and a brisk rivalry sprang up between the two villages. The two were wisely consolidated in 1833. A public meeting of the citizens of both was held to determine the name of the united town; and, at the suggestion of Willard J. Daniels, the name Toledo was adopted. He had been reading a history of Spain, and urged the name of the old Moorish capital for the reasons that there was no town of that name in America, that it has a pleasant sound and is easily pronounced. Toledo was incorporated as a city in 1846.

The town had slow growth until the opening of the Wabash and Erie Canal, from Toledo to the fertile Wabash Valley in Indiana, in 1843, and of which from Defiance south to Cincinnati, called the Miami and Erie Canal, which was opened to traffic in 1845. In 1846 these two canals brought to Toledo products valued at $3,000,000, while those going from Toledo to points on both aggregating nearly $5,000,000. The first railroad to reach Toledo was called the Erie and Kalamazoo, which was opened from Toledo to Adrian, Mich., in 1836, the cars being drawn by horses. The next year a locomotive was put on the line, and a contract for carrying the mails was obtained from the government. The road was sold by the sheriff in 1842, and its line is now part of the great New York Central system.

Population.—The population (1840) was 1,223; (1850), 3,017; (1860), 13,182; (1870), 66,497; (1880) est. 262,000.

RAYMOND T. SKINNER,
Toledo Commercial Club.

TOLEDO (Sp. tô-lâ'tho), Philippines, pueblos, province of Cebu, on the west coast, 35 miles west of the pueblo of Cebu. Petroleum and natural gas are reported in the vicinity. Pop. about 13,300.

TOLEDO, Spain, in New Castile, capital of a province of the same name, on the Tagus, 45 miles southwest of Madrid. It is the archiepiscopal see of the primacy of Spain. The city is walled and occupies an activity, around which rise lofty mountains. The city is built compactly, houses crowded, streets steep, winding, narrow. The chief public buildings are the Alcazar (1551), once including fortress and palace, which occupies a central and high point of the town; the great Gothic cathedral (1227-1494), a vast imposing edifice of great architectural merit, which has seen many vicissitudes for it retains some fine stained glass and a choir of marvelous beauty. The large church of Zocodover is the fashionable pew and thoroughly Moorish in character. The heretics were burned at the bull's-eye place. There are besides a theological monastery, several palaces and hospice manufactures comprise the famous sword-blades, small arms, church vestments, silks, wool and cotton finest confections. Toledo was the ancient all Spain and important in the city. It was taken by the Romans in 150 and subsequently was occupied in Gots, Moors and Castilian monar and also the seat of the Inquisition (q.v.). The town is now sadly decadent. The town was often damaged by fire, has been considerable expense. Pop., about 200,000.

A. F., "Toledo: an Historical and Descriptive Account" (New York 1919).

TOLEDO NEWSBOYS' A. TION, The, was organized 1892, by John E. Gunckel (q.v.), as the president. Mr. Gunckel remained president of the organization until his death in 1915. The outpacing efforts of the association had a growth and was the means of reclaiming heretofore neglected boy and girl and giving them their lives, making them useful citizens, capable of carrying on the furthering the plans of the organization, which, like all cities, must be a generation. To-day former size of the association is filling and its managing the great business city. Following his death, Mr. J. D. Robinson, one of Toledo's greatest philanthropists, was its president, and again the association is placed on a solid foundation.

A history of the association has its enjoyment and prosperity. The association is as the city, loyally supported by the philanthropic people of the city, and every advantage is offered by the streets to become a useful and honest citizen. The boys are constantly warned of evils and dangers that beset them and to refrain from gambling, stealing, lying, drinking, smoking, cigarettes, and going into saloons or associating in company. A fine brick building built in 1915 costing $110,000, dedicated to the newboys, Toledo, furnishes them one of the finest among young persons in the city together with a spacious well-equipped gymnasium and swimming pool of large capacity, fine library rooms, furnished kitchen and dining-rooms, and special rooms for band and orchestra practice, where the association maintains a piece band and 14-piece orchestra. The association now has a membership of 11,500. Its day afternoon entertainments, a special feature of the association, from 1 October to 31 December given by the schools, churches and other organizations of the city, are highly approved by the boys. A fine auditorium has been filled to its capacity. The association maintains a court of investigation, where boys are required to account for misconduct. The employment bureau within the association provides a valuable asset, and many boys are placed in responsible positions, later to best
or managers. The boys are en- l to return all found articles to the Articles of more than $50,000 have turned to their rightful owners, for is it found, the "honor" badge. In the entire association is tendered an or better known "Field day," which iis to add a bright page to the history ewshoy.

EDO WAR, The, a name popularly the contest over the division line be- ficham on the north and Indiana and the south. It arose out of an error in- tion of the southern point of Lake 2. In 1805 the Territory of Michigan inuniied in conformity with the Ordinance which provided that the line between diana and Illinois on the south, and the on the north, should be "an east and e running through the southern point Michigan." This was set down on the the times 42° 32' N., but when Michi-organized it was found that the true ough the southern point of Lake Michi- miles to the south, or 41° 37' 19" N., more southerly line was adopted. But diana and Illinois were organized as the northern line was adopted, and there i left a belt 65 miles broad claimed by actions. Congress ordered a survey, as completed in 1817, establishing the line, near the northern one. But the Michigan protested vehemently, as the Toledo was in the disputed belt. In oy act of legislature organized town- this territory, which had long been the control of Michigan. Then both 1 and Ohio appealed to President Jack- got no relief. The governor of Ohio it the militia, the governor of Michigan wise and occupied Toledo. When it is a conflict could no longer be pre- re matter was settled by the admis- gan to the Union as a State upon con- her acceptance of the "Harris" line, ing her in recompense the northern part peninsula of Wisconsin. Great deposits r and iron being found in this penin- igichigan accepted the conditions and the Union as a State 26 Jan. 1837. See TOLL, Eduard, Baron von, Russian explorer: b. 1850; d. 1902. In 1885 he began to explore the Post-Tertiary fauna of the Jana region, and in 1893 found the body of a mam- moth in the ice near the delta of the Jana. Later he commanded the Sarja expedition which wintered on the west coast of Kotelnoi Island (1901-02) and discovered large deposits of Post-Tertiary fauna, including mammoths, reindeer, etc., in the great ice-cliffs there. With F. G. Seeberg he started south in November 1902, and perished on Bennett Island, where their records were found by Kolchek a year later. Consult Toll, Emma, "Die Russische Polarfahrt der Sarja" (Berlin 1909).

TOLL, a tax paid or a duty imposed for a privilege granted, such as the payment claimed by owners of a port of entry for the privilege of landing or shipping goods; the fee exacted by those who erect or maintain a bridge for the privilege of passing over the same; a portion of grain retained by the miller as his compensation for milling; a charge made by a member of a fair or exhibition for the privilege of exhibiting or selling goods; a compensation for services, especially for transportation, as canal or railway toll. In the United States tolls, as applied to bridges and highways, are a subject for State legislation, while those applying to rivers and harbors are usually in the provision of Congressional action. Tolls were at one time of international importance, since they were exacted on certain straits and tidal rivers by virtue of the sovereignty of a particular state, such as the Scheldt tolls and sound dues levied by Denmark. The tendency in the United States is to abolish tolls, and most bridges and
to civilization is persecution on account of re- ligious belief permitted by law.

In all ages enlightened minds have favored toleration. It was the rule among the ancient Greeks, and also among the Romans, until religion became so identified with state affairs that refusal to accept the state religion was treason to the government. Toleration was unknown in practice during the Middle Ages, although it had earnest advocates among Christians, Mohammedans and pagans. In modern times toleration has been a growth of the past three centuries. As late as the early part of the last century men were imprisoned in New England for refusing to pay taxes for maintenance of the local church. English Roman Catholic disabilities in 1829, but did not admit Jews to Parliament until 1858. In a legal sense toleration is now coextensive with civiliza- tion and semi-civilization, but education only can make it effective by causing the national and tolerant spirit to take the place of intolerance and fanaticism, wherever the latter pre- vail.

TOLERATION ACT, a statute of Wil- liam and Mary, under which freedom of wor- ship was granted to Protestant dissenters from the Church of England, provided they made a declaration against transubstantiation and took the oaths of allegiance and supremacy. See Toler- ation.

TÓLIMA, to-lé'má, Colombia, a volcano rising from the central cordillera of the Co- lombian Andes to a height of 18,320 feet.

ERATION, a word meaning in its sense forebearance without approval, as state has an established church, but which are tolerated—that is, their are permitted to worship in their own place of worship without any religion. It was much America, however, in a narrower, or a broader, sense, during the struggle to to the compulsory support of Con- nected with the taxpaying in cer- ry England States, especially Connecti- cicut is now universal in civilized so far as permission to worship is d, but some restriction still exists as to ng by Roman Catholics in Sweden, and a certain degree of intolerance toward its in some South American republics, however, in any country pretending
highways are now free to the public. See Taxation.

TOLMAN, Herbert Cushing, American Greek scholar; b. South Scituate, Mass., 4 Nov. 1865. He was graduated at Yale and studied at the universities of Berlin and Munich. He received his Ph.D., from Yale and was honored with the degree of D.D., from Peabody College and S.T.D., Hobart College, and L.L.D., University of Nashville. From 1884 he was head of the Greek department of Vanderbilt University and is the author of several works on classical and philological subjects. His 'Ancient Persian Lexicon and Texts' and 'Ancient Persian Lexicon and Coptic Supplement' were adopted immediately after publication by the universities of Germany and were recognized by foreign philological reviews as superseding what had yet been done in that line of research, while the American Journal of Philology and the New York Nation spoke of the author as the leading American authority in the field of ancient Persian language. He was the first to identify positively the hitherto unknown season of the Persian month, Garmadporda, with June-July, an identification of great value to historians in fixing accurately several important dates. Dr. Tolman was elected president of Hobart College in 1913, but declined. In 1915 he was appointed dean of the College of Arts and Science of Vanderbilt University.

TOLMAN, William Howe, American safety engineer; b. Pawtucket, R. I., 2 June 1861. In 1882 he was graduated at Brown University and from 1894 to 1896 was general agent of the American Association for Improving the Condition of the Poor, and served as secretary of the New York commission on public baths and of the improved housing council of the same city. He is founder and from 1908 to 1916 was director of the American Museum of Safety. He has taken part in national housing congresses and is member of several societies for social betterment, both American and foreign. Dr. Tolman is the author of 'History of Higher Education in Rhode Island' (1901); 'Municipal Housing in the United States' (1894); 'Handbook of Sociological Reference for New York City' (1894); 'Report on Public Baths and Comfort Stations' (1897); 'The Better New York' (1906); 'Social Engineering' (1909); 'Hygiene for the Worker' (1912); 'Safety' (1913); also 'Industrial Betterment,' a monograph prepared for the United States Section of Social Economy, Paris Exposition of 1900, and various review articles.

TOLOWA, toł'owa, originally the name of a village, but extended to designate a tribe of the Athapaskan stock of North American Indians occupying the coast of California from a point a few miles north of the mouth of Klamath River northward to a short distance beyond the boundary of Oregon and the valley of Smith River. They were noted basketmakers and fishermen, especially on salmon and other fish. In 1842 they were placed on a reservation, which was abandoned six years later, since which time they dwindled and largely disappeared.

TOLSTOY, Count Lyof Nikolaievitch, Russian novelist and social reformer; b. Yasnaya Polyana, government of Tula, 9 Nov. 1828; d. Astapova, 20 Nov. 1910. In languages and law at the University of Moscow. In 1851 he went to the Caucasus despatch of artillery and he served at Sevastopol during the Crimean. This period of his career he spent in literary works, among them the memorial 'Childhood,' Boyhood, and 'Confession.' A brilliant description of the Crimean entitled 'Sevastopol in December' was published in August 1855, and 'Sevastopol in May 1855' and 'The Invasion,' the army on the conclusion of the war with Saint Petersburg, where he made his residence. Turgenev (q.v.) and other distinguished Russians and soon after he came to be known as a first-class writer. His return to his estate marked an epoch in his spiritual history. He retired to his estate and led a simpler life. He was greatly interested in the condition of the peasants and founded a village school on his property, for preparing teachers. At the end of two years, however, was closed, both on account of the government inspectors and the interest of the masters and pupils when he asked permission to reopen it after the government flatly refused. Happiness was issued in 1859 and was followed by 'Three Deaths' (1859), 'Po' (1860) and others. In 1862 he married a daughter of a Moscow physician. The news of his marriage was the completion of the latter novel. He began to develop his characteristic views of human and its effects upon the work of his literary reputation. 'War and Peace' (1865-69), the Napoleonic invasion of Russia; 'Karenina' (1877), a powerfully revealing human passion and its effects. It is a novel on the precept, 'Resist not evil.' His has much in common with the religion of his fellow-countrymen, but its peculiar religious basis gives it a character. In 1901 he was formally excommunicated by the Holy Synod of the Orthodox Church and in a reply to excommunication he clearly expressed the denial of the Trinity, of Jesus and his vicarious atonement, of conceptions of the future world, of sacramentalism and similar dogmas substantially identical with those of Unitarianism. Among the latest period, in which his views are more or less expressed the following: 'What the People Live upon' (1889); 'What to Do' (E. B. W.); 'My Confession'; 'My Religion,' and of Joan Ilyitch (1886); 'Where God is Also'; 'The Kingdom of God,' 'The Kreutzer Sonata'; 'Work while ye have the Light' (1890), a tale of the early Russian Power of Darkness, a drama; ;
ghtenment' (1891), a satirical comedy; 'and Servant'; 'Politics and Religion'; ism and Christianity' (1894), on the Russian alliance, and 'What is Art?' 'Resurrection' (1900) is a powerful f the same type as 'Anna Karenina,' are American translations by Dole, d and others (22 vols., New York 1902), Leo Wiener (24 vols., Boston 1904-05), gave up all privileges of rank in order a life of labor and asceticism and dur-great Russian families. He found abundant canty for carrying out his gospel of social (See ANNA KARENINA; WAR AND Consult De Vogüé, 'Le Roman Russe' Dupuy, C. E., 'Great Masters of Rusterature' (New York, 1886); Gan, ce. 'Tolstoy: His Life and Writings' n 1914); Howells, W. D., 'My Literary 3' (New York 1895); Lloyd, J. A. T., Russian Reformers: Ivan Turgenev and sly (ib. 1911); Löwenfeld, 'Leo (1802) Haude, A., 'The Life of o (2 vols., New York 1910; 4th ed., Merezhkovsky, D. S., 'Tolstoy as Man (ib. 1902); Rolland, R., 'Tolstoy' 1); Tolstoy, I., 'Reminiscences of (ib. 1944); Turner, 'Count Tolstoy elist and Thinker' (1888).

'TECS, töl'tëks or töl-täks', an Indian id to have occupied portions of the plateau previous to the advent of the Little is known of the race and that by through Aztec traditions and picture. They are supposed to have come from th and to have been supreme in their, from the 7th to the 11th century. principal city was Tolan, where they set up 661 A.D. from which they got the oltec. Lists of their kings or chiefs are - but these are considered untrust-bly antiques. The hero-god Quetzel-is supposed to have lived in their cities their overthrow, which came in 1013, they were driven south by savage tribes. records tell no more of the Toltocs, but e fact that the Quichés and other tribes e north are known to have settled in ita about this time, the inference is that they were banished Toltecs.

TOLTECS—TOLUENE 677

'TOCA, to-look'ká, Mexico's capital of e of Mexico, 36 miles southwest of City, on a division of the National', 8,761 feet above sea-level. Three railways — the Mexican National, the and San Juan and the Toluca and, all narrow gauge, supply transporta-tilities and there is a well-equipped street. The city is situated in the beautiful Toluca, just over the mountain range forms the western background of the capital. This valley, which lies at the the Toluca Mountain, is one of the tably productive and beautiful spots of public. The city was founded by the nca Indians and was advanced to the in rank of city in 1677. The industries a brewery, large flour-mills, glass-bottle two packing-houses and several mod-amenies. There is a local bank—the the State of Mexico—a branch of tional Bank and an agency of the Bank ton and Mexico. The city is well paved and provided with beautiful plazas, one of which contains a monument in honor of the patriot priest, Hidalgo, dedicated in 1900. In another plaza is a life-size figure in bronze, of Morelos, while in still another is an imposing monument to Columbus. A museum supported by the state occupies a spacious building and the State Library, containing some 11,000 vol-umes, is located in the immediate vicinity. The principal buildings are the palace of the state government, the municipal palace, the Scientific and Literary Institute, civil hospital, School of Trades and Arts. Pop. 33,000.

TOLUENE, methyl benzene, C6H5CH3, is an aromatic hydrocarbon present in American petroleum, in wood-tar and in coal-tar. Upon distillation coal-tar yields a fraction known as light oil, boiling at 100°-120° C. The toluene of commerce has been obtained from this fraction. Toluene has also been prepared (1) by the dry distillation of tolu balsam; (2) by heating bromobenzene with methyl iodide and metallic sodium (Pfitz Synthesis); (3) by treating benzene with methyl halide and dry aluminum chloride (Priedel-Craft Synthesis); (4) by heating toluic acid with lime. The enormous demand for toluene created by the European War, made it the subject of a number of patents. According to Fr. P. 479, 295, the compound is made by passing hydrochioric acid into boiling methyl alcohol in the presence of dehydrated zinc chloride and con-duting the methyl chloride produced into a mixture of benzene and dry aluminum chloride. Other patents claim to have obtained toluene from gas-tar naphtha by distilling under press-ure at 130°-240° C. (U. S. 1,225,237) or, from gas-drip naphtha, by passing it with steam and water-gas through checkerwork heated to about 800° C. (U. S. 1,230,087). To these may be added the widely-advertised "cracking" process, according to which toluene and benzene have been obtained by heating oils, containing aliphatic or aromatic hydrocarbons, at prescribed temperatures and pressures. The process has been tried on a large scale, but its success as a commercial enterprise has been seriously ques-tioned. Of much greater importance are the improvements inaugurated for the extraction of the maximum amount of toluene from cokes-oven or city gas supplies. It has been known for some time that only a small fraction of the toluene obtained from the by-products coke-ovens is recovered for commercial purposes, the greater proportion finding its way into city gas during the process of distillation. Toluene recovery plants have, therefore, been installed in all parts of the United States with the object of stripping illuminating gas of this material. As a result of this measure the toluene output for 1918 has probably exceeded 20,000,000 gal-lons. The maximum output for 1912-13 was not over 500,000 gallons.

Toluene is a colorless liquid with a boiling point of 110° C. and a specific gravity of 0.872 at 15° C. It is an excellent solvent for many organic compounds. With a side-chain that readily responds to a number of reactions and with a nucleus that can be nitrated, sulphonated, halogenated or reduced, toluene is capable of forming a large number of derivatives which are either useful commercial products or in-termediates for the manufacture of explosives,
synthetic dyes, perfumes, drugs, substitutes for sugar and poisons used in chemical warfare. Trinitrotoluene, saccharin, indigo-blue, bromo-benzyl cyanide, benzyl chloride, benzotrichloride, boric acid, nitrobenzene, toulidine, are some of the more important derivatives of this hydrocarbon.

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TOLUIDINE, CH₄N₄H₃, exists like all dissubstitution products of benzene in the ortho, meta and para modifications. When toluene is treated with nitric acid, a mixture of ortho- and para-nitrotoluenes is obtained. The reduction of this mixture yields the corresponding ortho- and para-toluidines. These are separated by strongly cooling the product, when the ortho compound remains as an oil, while the para compound solidifies and may be removed by filtration. Or, the mixed toluidines are treated with a quantity of sulphuric acid insufficient to effect complete neutralization; the ortho compound is now removed by distillation, while the para compound remains behind as a sulphate. It has also been noted that the oxalate of para-toluidine and its phosphate are much less soluble than the corresponding derivatives of the ortho compound. Upon these properties are based a number of methods for the separation of the two modifications. On account of the high cost of manufacture, meta-toluidine is used to a limited extent only. It has been obtained by the reduction of meta-nitrobenzal chloride. Meta-toluidine may be readily obtained from meta-nitrotoluene, but the latter can only be prepared on a commercial scale by indirect methods.

Ortho-toluidine is an oily liquid. It boils at 197°-199° C. and has a specific gravity of 1.102 at 4° C. Meta-toluidine is also an oily liquid with a boiling point of 203° C. and a specific gravity of 1.041 at 4° C. Para-toluidine is a solid which crystallizes in leaflets. It melts at 43°-45° C. and boils at 190° C.

Ortho- and para-toluidines are important intermediates in the dye industry. After diazotization they may be coupled with G Acid to form Ponceau G, with R Acid to produce Ponceau R7, with beta-naphthol sulphonic acid S to form Orange GT, and with dioxy-naphthalene sulphonic acid S to yield Azofuchsin B. Magenta is an oxidation product of a mixture of toluidines and aniline; Primuline is a fusion and sulphonation product of penta-toluidine and sulphur; Mauveine, Safranine, Chloramine Yellow, Cochenille Scarlet 2R, Spirit Yellow R, etc., are obtained from toluidines. Simple derivatives of toluidines have also been used for the manufacture of certain pigments; thus diazotized nitro-toluidines have been coupled with beta-naphthol producing Orange R, Fast Red 6H., Lithol and Fast Scarlet R.

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TOM, known as BLIND TOM. See Blind Tom.

TOM, Asia, a river in southern Siberia, in the government of Tomsk, rising in the Altai Mountains and joining the Angara. It is about 30 miles, flowing northward into the Ob. It begins to be navigable at Kusnez.

TOM BROWN'S SCHOOL DAYS, a story depicting English public-school life, written by Thomas Hughes and published in 1857, when the author was a young barrister of three-and-thirty. In its popularity it has never lost. Tom is a typical middle-class lad, with the distinctive British virtues of pluck, honesty and the love of fair play.

TOM JONES. 'The History of Tom Jones, a Foundling,' a novel by Henry Fielding, was published 28 Feb. 1749—a red-letter day in the calendar of English fiction, for the work in the opinion of many stands at the head of all novels ever written in our language. It succeeded several most interesting experiments in the novel of contemporary manners such as Richardson's 'Pamela' and 'Clarissa Harlowe,' Smollett's 'Roderick Random,' and his own 'Joseph Andrews.' When Fielding wrote 'Tom Jones,' his intellect, wonderfully observant and penetrative, was at full maturity; his pen he had long practised in the drama and the essay, and in fiction: his mind was highly cultivated in the ancient and modern literatures; he had associated with all classes of people, the high and the low, and he had thereby gained a knowledge of the men and women of his time unsurpassed by any then living. His aim was to present the very form and pressure of the age, and on the effort he expended 'some thousands of hours.' Having in mind the ancient epics, he divided his novel into 16 books, each with an initial chapter on the art and morality of that 'new province of writing' which he claimed to be introducing to the British public. In its original form, 'Tom Jones' filled six volumes, containing, all told, about 330,000 words.

For his comprehensive view, Fielding began his delineation of character in the country with two Somerset gentlemen—Mr. Allworthy and Squire Western, the one a Hanoverian and the other a Jacobite. Into the household of Allworthy he placed a sister, Bridget, and Deborah, a pair of nephews, Tom Jones and Master Blifil and their tutors, Square the Jew and Thwackum, the orthodox divine. Into the household of Western he placed a sister, Diana, daughter, Sophia and nurse, Mrs. Honour. Then, after describing life in the country while Tom and Sophia were growing up, he brought most of his characters up to London for contrast and interaction with more highly-seasoned men and women of the town. The manner in which Fielding conducted his story, concealing until the end the mystery of Tom's birth, has received the highest praise ever since the novel first appeared down to the eulogy by the late W. E. Hedges, Scott, for example, likened the narrative to an easy flow of a river through lands affording wide prospects; Coleridge thought the art structure of the plot was equaled only by that of the very greatest dramas, such as the 'Oedipus' of Sophocles. And in general, his exception has ever been taken to Fielding's craftsmanship beyond his introduction of the tale of the 'Man of the Hill,' the matter of which a modern novelist would manage differently. It is not to be inferred that Fielding laid out a plot by compass and rule. At the outset, he probably had in mind his conclusion.
but nothing more. He wrote at leisure, remembering what he had seen and heard, letting his story develop as he proceeded, casting his words in the German, and out and then giving them up at the end all the threads of his narrative into a consistent and impressive whole. This is the way that literary genius, in distinction from mere literary talent, works, and achieves its effects.

Apparently Fielding drew his characters in the main from real life. Where he followed his model too closely or where he deviated too far from it, his success was only partial. Squire Allworthy, who had an original in Ralph Allen, the philanthropist of Bath, is altogether too good for this world; he lacks those elements which really make a man, lovable and humorous as he is. Likewise Blifil, for whom no original was ever claimed, is hardly more than a stage villain, whose hypocrisy is so transparent that it should have been detected long before it had a chance to work its mischief. Thwackum and Square, though rather artificial creations, are always entertaining, for they have enough of their own to support their humorous passions. Partridge, the schoolmaster and barber, superstitious and afraid of his dreams, interested Voltaire greatly. Minor characters, like Diana Western, Mrs. Honour and Bridget Allworthy, are almost always admirable. For a superb creation we turn to Squire Western—the fox-hunting squire who goes to bed drunk and gets up in the morning before daybreak to follow the hounds, who loves his daughter better than all other creatures except his kennel, who quarrels with his sister, swearing great oaths referential. Under the excitement of Sophia's refusal to marry Blifil, he develops into a veritable whirlwind of contending passions. The height of the storm is reached in certain scenes with his sister, which, brutal as they are, have never been surpassed for humor in this language of ours. His daughter, Sophia, for whom Fielding's own wife, Charlotte Cradock sat, is a portrait of unusual charm. She is a real woman depicted in all her beauty, fine feeling, self-possession, modesty, vivacity and independence when the inevitable struggle comes between paternal tyranny and the promptings of her own heart. She wins the first great battle in our fiction for the enfranchisement of her sex.

The crux of the novel has always been the hero, who resembles Fielding himself in temperament but not in the incidents of his career. He is kind, generous, chivalrous and perfectly honest, but he is lacking in practical sense, and so gets into all sorts of mistakes in conduct. He loves Sophia desperately and would win her at all hazards. This passion, however, does not protect him against the allurement of other women, and herein lies the trouble. Generous critics overlook the boy's affairs with Molly Seagrave and Mrs. Waters, but they hold at the intrigue with Lady Bellaston. Had Fielding thrown in a word of explanation over that intrigue, Coleridge would have excused all. Here arises a question that may be terminally decided by a few words of explanation. The intrigue is necessary. He depicted the young man of his time as he was without comment. In thus keeping his art true to nature he acted rightly.

The influence of 'Tom Jones' cannot be well considered apart from the influence of Fielding's other works. The novel was immediately translated into French, Dutch and German, and Sud and French, and put through all the stages of publication in Polish and Russian. The French imitated it, dramatized parts of it and turned it into a comic opera. The Germans appropriated its disquisitions on the art of fiction and to some extent wrote novels in its style. 'Tom Jones' has probably been reprinted in English a hundred and fifty times. To pass by a host of imitations, it suggested the general outline of plot to Scott for 'Waverley,' his first novel; its spirit permeates the best work of Thackeray, and 'Pendennis' was written in direct imitation. In short, to 'Tom Jones' nearly all succeeding novelists are indebted who have aimed to depict life, not as it ought to be, but as it really is. Since Fielding's day fiction has extended its scope to include things never dreamed of by him; but for method, manner and procedure his art is the source. Scott called him 'the Father of the English Novel.'

Wilbur L. Cross.

TOM MOUNTAIN, in Hampshire County, Mass., between Holyoke and Northampton, and overlooking the Connecticut Valley. Though only 1,214 feet in height, thousands of tourists ascend Mount Tom each year on account of the grand view from its summit.

TOM THUMB. See Straton, Charles Sherwood.

TOM-TOM, or TAM-TAM, a native East Indian drum used by musicians, jugglers, public criers, etc. It is generally cylindrical in form, the depth of body being about three times the diameter of the heads, of which there are two. It is made of resonant wood or of hard-baked earthenware, and the heads are covered with skins, drawn tight by side-lacings, as in the modern drum. It is beaten with the fingers or the open hand and produces a hollow monotonous sound. Similar instruments used by the natives of western Africa receive the name of tom-tom, as do also certain types of Chinese gongs.

TOMAH, Wis., city in Monroe County, on the Chicago, Milwaukee and Saint Paul Railroad, 42 miles northeast of La Crosse. It is the site of a government industrial Indian school and contains the railroad bridge works and a large saw-mill, Pop. about 4,000.

TOMAHAWK, Wis., city in Lincoln County, on the Chicago, Milwaukee and Saint Paul and the Marinette, Tomahawk and Western railroads. It is 23 miles north of Merrill on the Wisconsin River. The principal industries are saw-mills, woodworking plants, pulp and paper factories and a tannery. Pop. about 3,000.

TOMAHAWK, a weapon of warfare of North American Indians, a light war axe. Before the advent of the white traders the head of the axe was usually a piece of stone sharpened at both ends and put through a piece of wood for a handle; sometimes the stone was two-edged and more like a modern double-axe; sometimes hard horn was sharpened and used in the place of the stone. But the white traders brought the natives, iron hatchet heads and the stone ones were gradually discarded. These hatchets had but one cutting edge, the
other shorter end being formed into a hammer-head, or often into the bowl of a pipe, which communicated with a tubular hollow made in the handle, thus made to serve as a pipe. In some instances of burying their tomahawks when they made peace with a foe comes the custom of saying that two opponents who have made peace have "buried the hatchet." (1)

**TOMALES,** to-má-lés, a bay on the coast of California, reaching the ocean, about 40 miles north of San Francisco. It is a narrow inlet of the Pacific, the railroad is near and parallel to its eastern shore, and Tomales Point is on the west, separating the bay from the ocean. The village of Tomales is a short distance inland.

**TOMAN,** or **TOMAUN,** a current gold coin of Persia, varying in value from $1.75 to $2.50 in the market. It is reckoned as the equivalent of 100 shahs or shakis.

**TOMATO,** a perennial herb (*Lycopersicon lycopersicon*) of the family **Solanaceae.** It is a native of western South America, whence it was introduced into cultivation in Europe during the 16th century. At first the wrinkled fruits were regarded with suspicion or disfavor, and were more popular as garden ornaments than for other purposes. During the 18th century both yellow and red-fruited sorts were known, but not until the middle of the 19th century was there a decided improvement in the form of the fruit. At the beginning of that century the fruits were used to a small extent for pickles and preserves, but less for other purposes. The development of the tomato both in its form and its popularity as a vegetable is mainly due to the care of plant breeders, who have eliminated the wrinkles from the fruit, and to the development of perfect methods of canning. The annual consumption of tomatoes, both as a salad and cooked or preserved in various ways, aggregates thousands of tons in the United States, where the crop is more widely grown than in any other country of the world. The season opens in mid-winter in Florida and the Mississippi delta, and advances northward until September, when it ends in Canada. Considerable quantities of tomatoes are forced in greenhouses at various seasons, but especially during the spring months.

Though perennial in its native country and in other frostless climates, the tomato is best known in the temperate regions as an annual herb. It is a straggling, clammy, ill-smelling, grayish-green plant, with variously formed pinnae leaves and small racemes of small yellowish flowers, followed by fleshy many-seeded berries which in some improved horticultural varieties weigh more than a pound. Several botanical varieties have been recognized, among which the following are best known: a *Cherry* tomato (*L. lycopersicon, var. cerasiforme*), grown in gardens for its little yellow or red globular fruits which are used for home-made preserves and pickles; pear and plum tomato (*var. physiforme*), similar to preceding except in form of fruit; large-leaf tomato (*var. grandifolium*), a group of varieties originated during the closing quarter of the 19th century, and including some of the most important commercial varieties; the common tomato (*var. vulgare*), the most widely cultivated form in America. One other species is cultivated more for ornament than for its fruit, which, although edible, is too small for general household raisin tomato. The plant is very spreading and branches, with small egg-shaped leaves and long racemes often bearing more than 30 currant-like red fruits. It has produced hybrids with the preceding species, and is useful for covering unsightly objects during the summer. The former species has been grafted upon to close relative, the potato, but the two plants have never been known to cross-fertilize. These grafts are interesting as curiosities but not otherwise.

Several other plants have been called tomato; the best known are probably the husk tomato (*Physalis pubescens*), also known as the strawberry tomato, ground cherry and dwarf cape gooseberry. It is popular in gardens for its fruits which are made into preserves or kept in their husks in cool dry rooms until needed for use in mid-winter. The name strawberry tomato is also given to *Physalis alkekengi,* better known by its specific name and as the winter cherry or bladder cherry. The red fruits are edible, but are not generally relished. The plant is chiefly ornamental on account of its very showy blood-red calyces. The tree tomato (*Cyphomandra betacea*) is cultivated to a small extent for its light brown, egg-shaped fruits, which resemble the tomato in flavor but are rather more musky and acid.

In cool climates the seeds are generally sown under glass in early spring and pricked out in flats, boxes or pots when the first pair of true leaves appear, allowing them to stand in the former not closer than three by three inches or two by six inches. Abundant ventilation should be given at all times and the temperature kept rather low to make the plants grow stocky and able to adapt themselves readily and without check to the conditions of the field. At this time they are five inches tall. The sturdier the plant, the less is it likely to suffer under ordinary conditions and care when set in the field, the earlier will it commence to bear, and the more profitable will be the fruit.

Whenever possible the tomato should be planted on rather rich loamy soil of medium texture and well exposed to the sun. Good drainage is essential. It is generally best to apply stable manure to previous crops because the applications made during the preceding year are thought to impale the fruits as well as to induce a growth of vine at the expense of produce. In the field the plants are usually set five feet apart each way, and when grown intensively each sixth or eighth plant is omitted and each 15th or 20th is skipped, so as to facilitate hand labor. There is least injury to the vines, waggons, etc., across the field to distribute the vines and collect the fruit. The vines spread and thus prevent tillage, etc., when given weekly to keep the surface from weeds. Often a top dressing of...
readily soluble fertilizer is given after the plants have been in the field about a month. Stem supports and fence for tomatoes are often trained in many ways, especially to stakes, upon slat frames and trellises. For such the plants are subjected to more or less pruning and tying, which usually vary with individual growers but the single stem is usually conceded to be the best method of growing such plants. The advantages secured by training are early ripening and better colored, larger sized and superior flavored fruits.

Since the vines are tender to frost the tomato is usually cut short before mid-autumn. There are, however, at that time many fruits approximately mature, besides large quantities less advanced. The former may be gathered and ripened in warm rooms or sunny windows, and by storing in cool places from which they can be removed to warmth as needed the season may be extended several weeks after the vines have been destroyed. The greener fruits are widely used for making sweet pickles, chow-chow and "India relish."

In greenhouses the tomato is one of the most popular vegetable crops. Though it is often grown in special houses or as the leading crop it is probably more frequently employed as a successor to carnations and some other greenhouse plants, which either commence to fail in the early spring months or have a smaller sale when brought into competition with spring flowers. The fruits are sought for Easter time and from then until the out-door plants commence to bear the greenhouses may often be very profitably employed. Hand pollination is generally considered essential to the setting of the fruit and the labor this involves is often a drawback on account of its expense. The plants are raised usually from seeds, sometimes from cuttings, or the rooted tips of plants which previously occupied the benches. They are planted in soil similar to that in favorable fields, either in solid beds, on shallow benches, or in boxes or pots, the second being preferred. The single plants are usually trained on a single stem supported either by a stout cord suspended from the sabbars, or upon a trellis, the former preferred. Two feet apart is the favorite distance; five feet the preferred height; a minimum temperature of 60° is the lowest night temperature; 65° being preferred by most growers. Abundant light and air must be given at all times, but water must be carefully controlled, especially in cloudy weather, because the plants are apt to grow too rapidly to foliage if water is in excessive supply. During the winter months an average crop of three pounds of fruit to each plant trained to a single stem is considered fairly good. In the spring months four pounds is perhaps below the average. Unless 30 cents a pound can be realized during the winter the crop is rarely paying, and many growers set the profitable figure at 40 cents a pound. In the spring a somewhat lower price with a rather higher average production makes the crop profitable.

The more progressive tomato growers are alive to the fact that the so-called plant diseases which have been reported injurious to the tomato are more readily prevented by intelligent management of the plants than by the use of so-called remedies. Every effort is, therefore, made to keep the conditions in the seedbed as well as in the field as favorable as possible. Adequate ventilation, rather low temperature and limited water supply are found conducive to the health of the seedlings. And sturdiness at the time of setting in the field is a safeguard against subsequent troubles. Growers whose methods produce inferior plants, or who are negligent in various other respects, often suffer serious losses; and perhaps the majority still have recourse to fungicides, none of which have been found fully satisfactory and in some instances have failed completely from the first trial.

Many insects feed upon the tomato, but very few are usually numerous enough to do serious damage. The best known are probably the tomato worm (Helicoverpa armigera) the tobacco-worm (Pheromone carolinus) and various species of cutworms. Flea-beetles, potato-beetles and thrips are also well-known enemies. As a rule, however, they are not responsible for serious damage. Certain species are generally picked off by hand and the smaller are driven away to other plants by the use of repellant and tobacco dust, Bordeaux mixture, etc. See Fungicides; Insecticides.

Consult Bailey, 'Standard Cyclopaedia of Horticulture' (New York 1916); and numerous bulletins of the agricultural experiment stations and of the United States Department of Agriculture.

M. G. KAINS,
Horticultural Consultant.

TOMB, a vault, cavity, niche, excavation or chamber to receive the dead body of a human being; also the monument erected to his memory, or the combined structure that answers both of these purposes. Among Eastern peoples at times the body was left entire and the remains of the dead in excavated chambers or in case the dead bodies were first burnt, to place urns containing the ashes in such chambers. These structures even in times of great antiquity were adorned with appropriate inscriptions. Early tombs often bore character writing, telling of the parentage and the place of residence, perhaps the station of life, of the deceased, and, in the case of heroes, the history of achievement was in all likelihood carved on the walls of the structure. Rude peoples whose only means of written expression was by picture-writing have employed that language to tell of the exploits of dead. Tombs are often designed to contain the remains of more than one person, and of such were the Roman columbarium and the Egyptian pyramids. With some rates tombs were made elaborate objects of art; with others, such as the Greeks, they were highly artistic but simple and tasteful. The stone or flat stone set up to mark a grave was often highly carved, and the stele of Dexileos in Athens is famous. Large edifices built as monuments to the dead are not found in Greece, but were common in the semi-Greek lands of Asia, the most noted being that of King Mausolus of Caria, whence comes the term Mausoleum (q.v.). Roman monuments were of great splendor, as is attested by the few examples remaining to the present time. They were
often of large proportions, the so-called "Castle of Saint Angelo" being nothing else than the tomb of the Emperor Hadrian and his successors, stripped of its sculptures, its marble colonnade, its probable conical superstructure, and crowed with defensive works that made of it a veritable citadel. Other tombs of great splendor are found outside of the walls of Rome and although despoiled and in some instances subverted to the purposes of other, adjacent architectures, they testify to the wealth and the artistic attention which the Romans bestowed on them. Pompeii, too, had its long street of magnificent tombs, which has been partially uncovered outside the limits of the city proper. In portions of Italy and in some of the older Spanish-American towns burial in the cemeteries were made in niches which rose row above row, terrace-like. In the niches rested coffins bearing the bodies. Burial in churches was prohibited during the earlier centuries of Christianity, but from the custom of erecting churches or chapels over graves of martyrs the custom arose to bury monarchs under the cover of the church, and the most important tombs of the Middle Ages are generally so situated. The earlier examples consist of a simple stone coffin of sarcophagus, often with a low, gabled lid and a sculptured cross. Following these come the altar-tombs, in the form of a table, and subsequently, in the 13th century, a species of sarcophagus bearing a recumbent figure of the deceased, the whole surmounted by a canopy, often of exquisite beauty of design. Still more stable are the churchyard tombs of which fine examples are seen in the tombs of La Scala in the churchyard of Santa Maria Antica in Verona. The tombs of the Renaissance period became more and more complex. The sarcophagus was disguised and subordinated to the decorations of sculptured upholstery and groups of symbolic or mythological figures. Immediately following the Middle Ages, the beauty and value of the statuary employed partly compensated for the loss of architectural design, as is the case in Michelangelo's tombs; but in succeeding years this redeeming feature was lost and tomb sculpture rapidly declined. The tomb placed in a niche in a church naturally suggested the memorial tablets of more recent years. The tomb of the Virgin Mary is venerated near Jerusalem, in the Cedron Valley. The sepulcher is completely below the present ground level, and is reached by a stone stairway descending 48 steps. Consult the pamphlet by Jean Baptiste Christyn, "Les tombeaux des hommes illustres," etc. (1674); and the paper by MM. S. Mercier, "Le tombe di Verona" in "Teatro italiano moderno" (Vol. II, 1792).

TOMBAC, an alloy consisting of from about 75 to 80 parts copper, mixed with 15 to 25 parts zinc, and used as an imitation of gold for cheap jewelry. When arsenic is added it forms white tombac.

TOMBIGEE, tom-big'i, a river rising in Tallapoosa County, in the northeast corner of Mississippi, and flowing south to Lowndes County where it enters Pickens County in Alabama. It continues an irregular southern course and unites with the Alabama River, 45 miles north of Mobile, at the point of junction the waters enter Mobile Bay by Mobile (q.v.) and Tensas (q.v.) rivers. Its total length is over 500 miles. It is navigable for 412 miles from Mobile Bay, to Alberti, Miss.

TOMBS, The, a noted city prison in New York. It occupies the entire block bounded by Center, Elm, Leonard and Franklin streets, is connected with the criminal courts by a story closed passage, locally known as "bridge of sighs." The Old Tom built in 1838 was replaced in 1867 structure on the Center street. The old building still standing is nothing of the fine Egyptian arch, the original structure was let for 20 years and the improvements are grand in their being dwarfed into insignificance by the high commercial value of the property. The prison covers a swell between the back of the Grounds and that long dedicated to its internal arrangement is such as which rise in tiers one above the other, used almost wholly for prisoners at.

TOMCOD, or FROST-FISH, a species of the small cod (Microgadus tomcod) of the North Atlantic, usually abundant in the mouths of rivers after the first frosts of autumn, from 4 to 12 inches long, olive green above and silvery below. It is a valued food fish and has several useful relatives on the Pacific Coast.

TOMÉ, Jacob, American philanthropist. Born in York County, Pa., 13 Aug. 1810; died in Deposit, Md., 16 March 1898. In 1833 he settled in Port Deposit, and there acquired a farm in business. In 1864 he entered political life as State senator, being chairman of the Finance Committee, and was instrumenal in reducing the indebtedness of the State to the public welfare, and in promoting public benefit. In 1894 he erected a large gift to Dickinson College, the establishment of a technical school. Jacob Torn Institute, at Port Deposit, he erected at a cost of $1,600,000, and by it will permanently endowed with an equal fortune.

TOMÉ, tô'mě. See Concepción, Colombia.

TOMÉ, a post-village in Valencia City, New Mexico, on the Rio Grande River. In the 16th century it was settled by Spaniards and for years was the seat of an Indian himself, in 1708 it was destroyed by Comanche Indians, since which time it has retained its importance in the locality of about 500.

TOME INSTITUTE. See Jacob Torn Institute.

TOMLINSON, Everett T., American author. Born in Shiloh, N. J., 23 May, 1842, studied at Williams College, and was tutor in various preparatory schools in Eastern and Middle States, but in 1872 devoted himself to literature, part of the time writing of historical and political matters. His publications include: "The Boy Soldier," (1885); "Three Young Cavaliers," (1896); "Tecumseh's Young Braves," (1898); "Washington's Young Aides," (1899); "A Boy in the Revolution," (1899); "Over the Colonial Colors," (1902); "V'
INTERIOR OF TOMB OF PRINCE MERAB. (Part 1)

INTERIOR OF TOMB OF PRINCE MERAB. (Part 2)
A Yankee in the British Isles: A Lieutenant Under Upton (1903); 'The Rider of the Black' (1904); 'The Red Chief' (1905); 'Wining and Weeping' (1905); 'Four Boys in the Yellow' (1906); 'Marching Against the Iroquois' (1907); 'The Camel of the Mad Anthony' (1907); 'The Fruit of the Desert' (1907); 'Boys in the Land of Cotton' (1907); 'Anthony's Young Scout' (1908); 'Four on the Mississippi' (1908); 'Light Horse Andy's Legion' (1910); 'The Champion of the Kent' (1911); 'The Young Minute-Man' (1912); 'The Young Sharpshooter' (1912); 'Scouting With Daniel Boone' (1914); 'Young Americans Want to Know' (1915).

OMMASEO, tōm-ˈma-zō-ˈnoccō, Italio, Italo-historian and philosopher: b. Sebinico, at 1980; d. Florence, Italy, 1874, studied law in Padua but turned to literature and became known as a poet and critic, as well as a leading Florentine writer. He was the first in Europe to publish his work and his style was influential on the development of Italian literature. He went to Paris where he stayed from 1848 to 1874 to publish his great works in literature, his writing was influenced by the French and the Italian language. He was known for his vast and accurate knowledge as a philologist and his constant efforts to educate the people. He was the author of a number of works in Italian.

OMMY ATKINS, a generic nickname applied to British soldiers. It originated many years ago from certain printed forms—enlistment applications and military accounts, where a model, the name "Thomas Atkins" was used, like the mythical "John Doe" of American documents.

OMCHICHI, o-mō-chē-chē, a chief of the southern branch of the Creek Confederacy: the town of Apalachicola, Ga., about 1642; Savannah, Ga., 1739. He withdrew from onfederacy and with his followers went to Ceylon and its tributaries. In 1734 he accompanied the governor on a visit to England.

OMPICKS, Charles H., American soldier: b. Fort Monroe, Va., 12 Sept. 1830; d. Lexington, D. C., 1893. He studied at West Point, but resigned without completing his course. He was graduated from the U.S. Military Academy in 1856. In 1861, he enlisted in the navy and was promoted first lieutenant in second United States Cavalry in 1861. At the outbreak of the Civil War he was assigned to the defense of the national capital and was engaged in one of the first reconnoiter-expeditions. He was particularly distinguished for bravery in the Shenandoah campaign, and was brevetted brigadier-general in 1865. After the war he served as chief qua-re-

TOMPKINS, Daniel D., American statesman: b. Westchester County, N. Y., 21 June 1774; d. Staten Island, 11 June 1825. He was graduated at Columbia College in 1795, and afterward admitted to the bar, but soon entered public life. He was a member of the New York legislature and of the State Constitutional Convention in 1801 and in 1804 was elected to Congress, but was appointed to the State Supreme bench, and accepted that position instead of going to Washington. He was governor of New York in 1807-1817 and in 1817-25 was Vice-President of the United States. He took an active part in the War of 1812, and was one of the strongest and most able opponents of slavery. It was largely through his influence that the bill abolishing slavery in New York was kept before the legislature, but he did not live to see its enactment.

TOMPSON, Benjamin, American poet: b. Brandywine, Mass., 4 July 1762; d. Roxbury, Mass., 13 April 1718. He was graduated from Harvard and was long a teacher at Cambridge. He wrote "New England's Crisis," a long poem of King Philip's War.

TOM'S RIVER, N. J., village, county-seat of Ocean County, on the Pennsylvania and the Central of New Jersey railways, about 50 miles east of Philadelphia, 36 miles southeast of Trenton and four miles from Barnegat Bay. It is one of the colonial villages of New Jersey, and in the Revolutionary days was a haven for privateers. The salt found here made its place of importance in the settlement days. On 24 March 1782 the village was burned by the British. It is now a favorite summer resort. The chief industries are connected with the care of summer guests; but there are considerable shipments of cranberries, farm products, fish and oysters. It contains five churches, four schools and one bank. Permanent population about 1,500.

TOMSK, Asia, in western Siberia, (1) capital of the government of its own name, on the Tom (q.v.). It is the seat of a governor and of a bishop and of the chief town of West Siberia. It has 20 Russian churches, monastery, convent, synagogue, mosque, university with three faculties and 900 students, technological institute, theological seminary and various other schools for both sexes; also various scientific societies, Russian musical society, theatre, library, halting station for exported Russians, banks, harbor, etc. The industrial works comprise tanneries, distilleries, wagon factories, etc. There is a brisk transit trade with Siberia. It lies on a branch of the Siberian Railroad. Tomsk dates from 1604. Pop. about 117,000. (2) The government has an area of about 335,000 square miles and is in the south and southeast mountainous, and embraces the Altai system. The Obi and its tributaries are the chief streams. There are vast swamps in the flat districts. The climate is very cold and unhealthy. Storms and earthquakes occur often. Pop. about 4,000,000.

TON, a measure of weight and capacity, equivalent to 20 hundred-weight. As the historical "hundred-weight" of Great Britain and
the United States contains 112 pounds, the ton is reckoned as 2,240 pounds. This is known as a "long" ton. In some of the States legislation has made the ton consist of 2,000 pounds, being 20 hundred-weight of 100 pounds each. This is known as a "short" ton. United States laws make the ton equal to 2,240 pounds when not otherwise specified. A metric ton is 1,000 kilograms, or 2,204.6 pounds avoirdupois. A ton of earth is the equivalent of 21 cubic feet. As a measure of capacity, of a vessel or a car, a ton is 40 cubic feet; this is an "actual" ton. The "register" ton contains 100 cubic feet. See Tonnage.

Applied to liquid measure the word, in the form tun, was in common use with the old English wine dealers. A tun of beer contained 216 gallons, of 282 cubic inches each, while a ton of wine contained 252 gallons of 281 cubic inches each.

TONALITY, in music, the character and quality of tone. Good tonality demands: correctness of pitch, the production of sounds whose time being termed of doubtful tonality; correctness of intonation; and correctness of key relation, a passage wanting in definiteness of key or scale being termed of uncertain tonality. The word has been adopted by an opera and applied to painting in considering the system of tones, or the color scheme, of a picture.

TONAWANDA, tōn-a-wan'da, N. Y., city in Erie County, on the Niagara River, Tonawanda Creek and Erie Canal, and on the New York Central and Hudson River Railroad, opposite North Tonawanda and 10 miles north of Buffalo. Several railroads pass through and electric lines connect with Buffalo and Niagara Falls. It is in a fertile agricultural region, and on account of the good water power extensive manufacturing interests have been developed. The chief manufactures are steel, lumber and lumber products and paper boards. There are about 75 manufacturing establishments making products of the annual value of $2,300,000. The educational institutions are a high school, public and parish schools and a public library. The two banks have a combined capital of over $300,000. Pop. 9,147.

TONBRIDGE, English market town in Kent, 29 miles southeast of London, on the Medway River. It contains the remains of a medieval castle which stands near the entrance to the town, a parish church and a grammar school founded about 1550. It is noted for the manufacture of a peculiar kind of wooden ware known as "Tonbridge ware." Pop. about 17,500.

TONDO, tōn-dō, Philippines, a district of the city of Manila, the most northern district on the bay shore. The streets are mostly narrow, the houses built of cane and nipa; it contains a large church and convent, the station of the Manil and Dapitan Railroad, and the city slaughter-house. The inhabitants are mostly fishermen and laborers engaged in the tobacco and cigar industries.

TONE, Theobald Wolfe, leader of the United Irishmen: b. Dublin, 20 June 1763; d. there, 1779. He was graduated at Trinity College, Dublin, in 1786, practiced law for a time without much success and gradually politics became his absorbing interest. He held republican opinions, and believed that Ireland ought to assert her rights as an independent nation; but the objects of the clubs of United Irishmen started at Belfast and Dublin in 1791 were limited to legislative reform. In 1792 he was appointed secretary of the general Committee. The government came to know through a spy that he had given information in 1794 on the question of invasion to an emissary of the French government, but they permitted him to leave the country and go to America. He sailed from New York to France in 1795, and urged the French government to undertake an invasion of Ireland. He was adjutant-general in Hoche's abortive expedition against Ireland in 1796, and he afterward served under Hoche on land. He accompanied one of the small French expeditions sent to assist the Irish rebels in 1798, but was taken prisoner after a brief naval engagement near Lough Swilly. He was tried by court-martial at Dublin, convicted of treason, and was executed by firing on 22 March, 1798.

The Toner was issued by Barry O'Brien (1833).

TONE, sound considered with reference to its pitch, timbre, duration and volume. Nearly all tones in music are composite, consisting of several simple constituents having different rates of vibration and known as partial tones. They vibrate according to fixed laws, the pitch depending on the nature of the sonorous body and the mode of producing its vibration. The partial tone having the lowest pitch (and usually the least sound) is called the prime or fundamental tone, while the other partial tones are called harmonics or overtones. Tones differ in quality or timbre according to the number and relative force of their partial tones. A pure tone is a simple harmonic vibration. The seventh tone of a scale is characteristic tone; two tones coalescing are termed combinational. The interval of a major second is called a tone or whole tone, half of such interval being a semitone. When a piano key is sounded it produces the character of that note is a tone; the character of all the notes of an instrument gives the tone of the instrument. See Note: Pitch.

Toner, Joseph Meredith, American physician: b. Pittsburgh, Pa., 30 April 1825; d. Washington, D. C., 1 Aug. 1896. He was graduated at the Jefferson Medical College in 1853 and established himself as a medical practitioner in Washington in 1855. He was the originator of the plan for the American Medical Association Library established in Washington in 1868 and made a part of the Smithsonian Institution, founded the Providence Hospital and Saint Ann's Infant Asylum in Washington and in 1871 the Toner lectures under the auspices of the Smithsonian Institution. He devised the system of symbols for the geographical localities which was adopted by the Post Office Department and made valuable researches into early American medical literature. His collection of 26,000 medical books and 18,000 pamphlets was presented to Congress in 1882. His publications include...
Maternal Instinct, or Love (1864); Medical Register of the United States (1874); Annuals of Medical Progress and Medical Education in the United States (1874); Medical Men of the Revolution (1876). Etc.

Tonga, Tonga, or Friendly Islands, Polynesia, a group of islands under British protection, situated in the south Pacific Ocean, mainly between lat. 18° 30' and 22° 30' S., and between long. 173° and 176° W., southeast of the Fiji Islands and southwest of Samos. They are sometimes classed as three groups, the Tonga-tabu, Haabai and Vavan. The group consists of about 200 islets with a total area of 390 square miles. The largest, Tonga-tabu, is 20 miles long. The islands are partly volcanic and mountainous, partly of low coral formation. They have been subject to considerable changes in modern times by volcanic action. The soil is fertile and the vegetation luxuriant. The chief productions are crops, fruits, mats and sponges. The annual imports and exports total each about $350,000, trade being mainly with Australia and New Zealand. The larger islands are visited every fortnight by the New Zealand Steamship Company. The inhabitants belong to the finest of the Polynesian types. They are peaceful, civilized and Christian, being mostly Wesleyan Methodists. Excellent schools and a college have been established by missionaries. The immediate ruler is King George II and native council, whose capital is Nukualofa on Tonga-tabu. The islands were discovered by Tasman in 1643. In 1845 they were united under one king. In May 1900 they were declared under British protection. Pop. about 24,000, including 380 Europeans.

Tongas, Tonga, a tribe of the Kaluschan stock of North American Indians, residing around Cape Fox and at the mouth of Portland Canal, southeastern Alaska. They number about 250.

Tongres, Tongr, Belgium, a town in the province of Limburg, on the Geer, 12 miles north of Liege. The church of Notre Dame (1240) is the first dedicated to the Virgin in the north. The cloister belongs to the 10th century. The industrial works include tanneries, distilleries and hat manufactories. The population before the war was about 10,000.

Tongue, the principal organ of the sense of taste and an essential part of the apparatus of speech in human beings. The name tongue is also given to various structures in invertebrates, as the proboscis of a lepidopter or the odontophore of a shellfish. In man the tongue is attached by its base or root to the hyoid bone and to the epiglottis. Its tip, sides, upper surface and part of its under surface are free. Its under surface is fixed to the lower jaw by the genio-hyoglossus muscles and from its sides the mucous membrane is reflected on the inner surface of the gums. In front of the under surface a fold of the mucous membrane is specially developed and is named the frenum lingue. The upper surface is convex and bears a deep middle line, the raphe, which ends behind in a deep follicle or sac—the foramen cecum. Two-thirds of the forward portion of the organ are rough and bear the characteristic structures known as papillae, in which the sense of taste resides. The posterior third is smooth and exhibits the openings of numerous mucous glands. The substance of the tongue consists of large numbers of muscles, which are named superior and inferior longitudinal and transverse muscles. The mucous membrane consists of an upper layer or cutis supporting papillae and covered with epithelium. This cutis supports the blood-vessels and nerves and into it the papillae of the tongue are inserted. The papillae, which cause the characteristic roughness of the tongue, are of three kinds. The circumvallate papillæ number from eight to 10. They are of large size and are placed on the hinder part of the upper surface and extend from the raphe in two diverging lines. Each of these papillae consists of a rounded central and flattened disc, situated in a cup-shaped depression or fossa. The exposed part of the papilla is itself covered with numerous papillæ. The fungiform papillæ are more numerous than the circumvallate and are scattered irregularly over the upper surface of the tongue, but are most plentiful on its apex and sides. They are of large size, of rounded prominence, and are of a deep red color. The filiform or front papilla are of very small size and are arranged in rows corresponding with the rows of the circumvallate papillæ. In structure the papillæ are like those of the skin (q.v.) and contain loops of capillary vessels as well as nervous filaments. The mode of termination of the nerves in the papillæ is hardly determined. Numerous follicles and mucous or lingual glands exist on the tongue, the functions of these latter being the secretion of mucus (q.v.). The epithelium (q.v.) of the tongue is of the flat or scaly kind, resembling that of the epidermis or outer skin, but the deeper cells of the epithelial layer do not contain any pigmenitary or coloring matter. The muscular halves or substance of the tongue are divided in the median line by a fibrous septum. The arteries are derived chiefly from the lingual and facial trunks and the nervous supply is distributed in the form of three main nerves to each half of the organ. The gustatory branch of the lingual nerve supplies the papillæ in front and those of the sides. The lingual branch of the glossopharyngeal nerve supplies the mucous membrane at the sides and base and also the circumvallate papillæ, while the hypoglossal nerve is distributed to the muscular substance of the organ.

The gustatory nerves and glossopharyngeal branches are the nerves which provide the tongue with common sensation and also with the sense of taste, the hypoglossal nerve being that which invests the muscles of the tongue with the necessary stimulus. The conditions which appear to be essential for the exercise of this sense are: (1) the solution of the matters to be tasted—that is, their presence in a form in which their particles may readily come in contact with the nerves of taste, there being thus a strong analogy between the sense of taste and that of touch, since the latter sense must be in a manner exercised before the taste of any substance can be perceived; (2) the presence of a specialized gustatory nerve, a necessary condition for the exercise of this sense. Occasionally it happens, however, that other stimuli than those produced by the actual
contact of sapid substances with the nerves of taste may excite that sense. If a current of cool air be directed on the tongue a saline taste is perceived; and a smart tap on the tongue will produce a taste analogous to that excited by electricity. A minute current of electricity can be detected by the tongue which is not observable by the eye or hand. It appears necessary that the surface of the tongue itself should be moist, in order that the gustatory sense may be exercised, and hence the inability to taste substances when the palate and fauces are dry and parched. The tongue itself does not appear to be the exclusive seat of this sense. The soft palate, uvula, tonsils and upper part of the pharynx in all probability exercise this sense, although in a minor degree when compared with the tongue. The middle of the tongue appears to be most feebly endowed with the sense of taste, the most sensitive region of the organ being the tip and edges. The tongue may occasionally lose its sense of taste and retain its sensibility to touch, or vice-versa. Surprisingly, the taste is not the same in every part of the tongue. While some substances taste alike when touched by every part of the tongue, other substances taste differently when applied to different parts of the tongue. Sensations of taste, or at any rate of the impressions of taste, may remain for long periods after the stimulus has disappeared, while the frequent repetition of the same taste dulls the sense. This sense may also be excited by internal stimuli as well as by those of external kind.

In the articulation of words, the modulation of sounds, the tongue plays an important part among the organs of speech; and in mastication, swallowing and nearly all the actions performed by the mouth the tongue is more or less concerned.

Various mechanical devices and structures thought to resemble the human tongue in some respect are so named, as the pole of a wagon, the fastening pin of a buckle, a vibrating slip in a musical reed, the tang of a tool, a strip of leather for closing the front gap in a laced shoe, etc.

**TONGUE-FISH,** an English name, corrupted from the French *tongue,* applied to young soles and other small edible flatfish found along the shores of the English Channel. The term has been applied by Jordan to the American genus *Sphyrnus* of sole-like fishes occurring on both United States coasts.

**TONGUE-TIE,** an abnormal attachment or adhesion of some part of the tongue to some portion of the surrounding structures of the mouth. The ordinary form of tongue-tie consists in an abnormal development of the frenum. The tongue, in consequence, cannot be extended beyond the lips, and speech and mastication, as well as speech, are impeded.

**TONGUES,** Confusion of, the punishment inflicted on the builders of Babel, according to the Biblical narrative, when God so confounded their language that they could not understand each other, though up to that time there had been only one language. The result was that the building of the tower was abandoned, and those who had been engaged in its erection were dispersed over various lands (Gen xi, 1-9).

**TONGUES,** Gift of, a gift bestowed in connection with the Pentecostal descent of the Holy Spirit. A saline taste is perceived; and a smart tap on the tongue will produce a taste analogous to that excited by electricity. A minute current of electricity can be detected by the tongue which is not observable by the eye or hand. It appears necessary that the surface of the tongue itself should be moist, in order that the gustatory sense may be exercised, and hence the inability to taste substances when the palate and fauces are dry and parched. The tongue itself does not appear to be the exclusive seat of this sense. The soft palate, uvula, tonsils and upper part of the pharynx in all probability exercise this sense, although in a minor degree when compared with the tongue. The middle of the tongue appears to be most feebly endowed with the sense of taste, the most sensitive region of the organ being the tip and edges. The tongue may occasionally lose its sense of taste and retain its sensibility to touch, or vice-versa. Surprisingly, the taste is not the same in every part of the tongue. While some substances taste alike when touched by every part of the tongue, other substances taste differently when applied to different parts of the tongue. Sensations of taste, or at any rate of the impressions of taste, may remain for long periods after the stimulus has disappeared, while the frequent repetition of the same taste dulls the sense. This sense may also be excited by internal stimuli as well as by those of external kind.

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icient remedy in most forms of anaemia, always easily assimilated and it is gen-
title in chronic wasting diseases and in affec-
tions.

IIKA, tön-ka (also TONICA and A), a tribe of North American Indians, a
distinct linguistic stock, and for-
siding on the Lower Yazoo in Missis-
tuck were first described by De Soto (1492).
They were allies of the French in their contests with neighboring
and in 1699 were reported to occupy 200
estuaries over four leagues. In 1706
re driven away by the Chickasaws and is,
and in 1730 were defeated by the
, who burned their village and killed a
of them. The remainder retired to the
Mississippi, where, in 1760, they occupied
ages, and in 1802 numbered about 400
The Tonikas were an agricultural tribe;
tended their heads and wore very little;
the women made pottery and a fabric
e mulberry. Polynesian was not com-
here are a few survivors of
, near Marksville, La., who speak their
unguage as well as Creole and English.

IK, India, a small native state of the
east of Ajmer-Merwara. Area,
tare miles; pop. about 303,000. It yields
an annual revenue of about $650,000.
ital, Tonk, about 60 miles south of as a population of 55,000.

IKA, tön-ka, Lower Siam. See PUKET.

IKA, TONCA, TONGA, or TON-
BEAN, is the fragrant seed of the
bush tree Diptera odorata, native to the
countries of South America. The tree
80 feet in height and bears fruits which
dike, oblong and fibrous and contain a
red. This is of the shape of an almond,
ter, in a shining black coat. Tonka
ve the fragrance of new-mown hay, due
one odorant principle, prismatic couma-
tse sweet vernal grass and melilot. They
for their aroma, either whole or pow-
er scenting clothes, snuff and in perfume-
evaporate as a substitute for vanila.

IKAWA, tön-ka-wä, a nomadic tribe of American Indians, comprising a
disguising stock. They formerly roamed the plains of Texas, were noted for their
istics and practices and were regarded as the
ranging tribes. Early in the
tury they were reported to number be-
000 and 3,000, but in 1857, when they
lled on a reservation on the upper River, in Texas, their number was offi-
mated at fewer than 1,000. During the
ar (5 Jan. 1862), owing to their refusal to Comanches, Delawares and others in
ction against the whites, the latter In-
tacked a party of some 200 Tonawas,
ng more than half the tribe, killing all
The remainder returned to Texas
ney stayed until 1884, when they were in a reservation in Oklahoma. Here the
ors now live with the Poncas.

KIN, tön-ken', TONKING, or CING, French Indo-China, a territory
reach position. Located on the north
a, on the east by the Gulf of Tonkin,
ish by Anam and on the west by Laos.

Area, 46,400 square miles. It is divided into 14 provinces and includes about 8,000 villages. It
consists of two mountainous regions surround-
ing on three sides the large alluvial plain and delta-region of the Song-koi (Red River), also an
intermediate region of plateaux. The Song-
koi flows through the centre of the territory from northwest to southeast and opens a naviga-
le waterway extending in the rainy season as far as Lao-kay. The Song-koi (known as the Black River)
ris in Yunnan and joins the Song-koi, the
largest river in the Mekong, forming a large
portion of the western boundary. The principal
eral resources are deposits of coal, iron,
copper and gold. The climate is hot and humid
and the alluvial plain of Tonkin produces some
of the best rice in the word. Sugar, cotton,
te, Indian corn and opium are also cultivated
to a great extent, and on the higher ground
there are coffee plantations. The manufacturers
clude silk, paper, cotton and textiles.
Commerce has rapidly increased, the ex-
ports, chiefly rice, maize, sugar cane, silk, cot-
ton, coffee, tobacco and animal products
ounting to about $10,000,000 annually. The
imports in 1915 totaled $5,000,000, being
ance, machinery and beverages. The principal
port is Hai-fong, which has steamship connec-
tion with Hongkong, Yokohama and Cochin-
China. Railroads run from Hanoi to Hai-fong
and Nam-dinh to Lungchow and to Yunnanfu
and to the Chinese frontier. There are ocean
ables connecting with Hongkong and Hue.
Hanoi is the capital, and, since 1902, also the
capital of the whole of French and Indo-China.
Tonkin was an independent state until 1802,
when it became a province of Anam. The lat-
ter is still its nominal position, although the
Anamite vice-royalty was superseded in 1897
by a French residency, and the French protec-
torate is more direct here than in Anam proper.
The provinces are governed by a resident and
vice-resident, and each is subdivided into four
military territories under commandants. Pop.
estimated in 1911 as 6,119,720, with 33,000 Chi-
inese and 6,132 Europeans.

TONKIN, Gulf of, Indo-China, an arm of the
Sea extending northward between the
French Indo-China and the Chinese island of
Hainan. It is about 400 miles long and 200
miles wide. It forms the coast of the protec-
torate of Tonkin and receives the commerce
brought down by the important river Song-
koi from a rich agricultural region.

TONKS, Oliver Samuel, American teacher of art: b. Malden, Mass., 24 Dec. 1874. He was graduated at Harvard University, where he
ook his Ph.D. degree in 1905, and was a
ellow of the American Classical School at
thens (1901-02). He served as assistant
curator of the department of classical art in the
Boston Museum of Fine Arts (1903), was in-
structor in Greek at the University of Vermont
(1904), lecturer at Columbia (1905) and pre-
ceptor in art and archaeology at Princeton
(1905-11). He then became professor of art in
Vassar College. He collaborated in writing "The Art Museum and the Public School" (1912).

TONNAGE, the carrying capacity of a
ship. As this capacity is variously measured
the word has several special meanings. As it comes
from the shipyard the ship's capacity is rated as "dead weight tonnage." As it is measured by maritime surveyors and registered as of so many tons, its capacity is the same as "gross registered tonnage" and "net registered tonnage," both figures being given, as in different ports dues are collected variously, sometimes on the gross and sometimes on the net tonnage. War vessels, which have no "carrying capacity" in the mercantile sense, are rated by their "displacement tonnage." Still another form is recognized among shippers as "cargo tonnage" or "measurement tonnage."

Displacement Tonne is the weight of sea water actually displaced by the vessel. It is computed usually by calculating from the drawings of the ship by the naval architect the cubic content of the immersed hull in feet and adding to that figure the number of cubic feet in the propeller, the shafting exterior of the hull, the engine, and the superstructure. This total is divided by 35, as 35 cubic feet of sea water weigh almost exactly one ton.

In ascertaining the carrying capacity of a ship under the old style of measurement (almost four-fifths), the depth of the vessel was assumed to be the same as its breadth and the tonnage was obtained by multiplying the length by the breadth by the depth and dividing the product by 94, the quotient being the tons burden. But this rule was found to be impracticable, since shipbuilders sought to evade tonnage and harbor dues by building their ships very narrow and deep. In 1835 the British Parliament remedied these defects by new measurement laws, which were amended by the Merchant Shipping Acts of 1854 and 1894. Under this system, known as the Moorsom, actual measurements of the depth of the vessel are made at certain intervals, the number of which depends on the length of the tonnage deck, and at these points transverse areas are computed.

Gross and Net Registered Tonnage.—For purposes of measuring tonnage the United States practice divides vessels into six classes based upon their length (the British into five). These lengths and the number of longitudinal sections into which they are respectively divided are as follows: I, vessels under 50 feet long, into six parts; II, between 50 feet and 100 feet, into eight parts; III, between 100 and 150 feet, into 10 parts; IV, between 150 and 200 feet, into 12 parts; V, between 200 and 250 feet, into 14 parts; VI, over 250 feet, into 16 parts. These divisions are set out on the "tonnage deck," which in a vessel with less than three decks is the upper deck; in a vessel with three or more decks is the second deck, counting from below. The depth of the vessel is measured on its centre line from the inside of the innermost plate or plank at the bow to the innermost side of the plate at the stern, but making allowance for rake. The stations being marked off at every 3 feet 6 inches, the product of the transverse areas are made at each station, the depth being first taken. This is the distance from one-third up the round of the beam at the bottom to the top of the deck beams, allowing two and one-half inches for each. If this depth at midship is more than six feet the figure representing the depth is divided into six equal parts and a transverse measurement is made at each division, and and the bottom. Counting from one second, fourth and sixth measurement multiplied by four, and the above the second multiplied by two. These products are added together, and to the sum thus obtained added the top measurement and the measurement. This total is then multiplied by one-third of the equal vertical distance which the depth was divided, and this is accepted as the transverse area at that point. These transverse areas are numbered successively from the bow to the stern. Omit first and last second, fourth and sixth succeeding area with an even number is multiplied by one; and the third, fifth and seventh succeeding area with an odd number is multiplied by two. These several products are added together and the first and last also; and the sum is then multiplied by one-third of the two equal longitudinal distances between stations. The total is the cubic content of the vessel in feet. This figure is divided by 100 and the quotient is the gross tonnage. To this is added the number of feet in all deck houses and permanently enclosed spaces which are above the main deck, and which are or may be used as regular cabins or as not available for fuel, stores or water. These additions are divided by added to the underdeck tonnage to gross registered tonnage. The net tonnage is computed by deducting from the full cubic content of the engine room, including the shaft tunnel, the crew houses, the coal bunkers, the carpenter's rooms, the spare parts, and all space needed in the navigation of the ship, and such part of the space in the cargo area as is not available for fuel, stores or water. The resulting product is multiplied by 0.25 per cent and added to the net tonnage. The result is the common practice to compare the gross tonnage with the gross tonnage and if it is from 20 to 25 per cent and under 20 per cent, the arbitrary deduction of 32 per cent for a vessel under 37 per cent for a vessel over 37 per cent for a vessel over 37 per cent, making the figure for the net tonnage. The deductions from the gross tonnage are the result of a long process of arbitration. The rule carries its gross tonnage figures as 'net figures for the calculation of canal dues by the local authorities.
OWN FOR MEASUREMENT, AS THEY HAVE TO DEAL WITH VESSELS OF ALL NATIONS. UNDER MODERN RULES ACCOUNT IS TAKEN OF THE SPACE IN DOUBLE BOTTOMS, NOW COMMONLY UTILIZED FOR FEED, WATER, OIL, FUEL, ETC., AND NO ALLOWANCE OF MORE THAN 5 PER CENT OF THE GROSS TonnAGE FOR CREW SPACE IS COUNTENANCED. DECKHOUSES, HOWEVER, WHICH ARE USED ONLY AS LOUNGING ROOMS FOR PASSENGERS ACCOMMODATED ELSEWHERE IN THE VESSEL ARE ALSO DEDUCED IN ARRIVING AT NET TONNAGE.

TOMONETER, IN MUSIC, AN INSTRUMENT FOR MEASURING THE PITCH OF TONES, SUCH AS A TUNING FORK OR A SET OF GRADUATED TUNING FORKS. THE BEST-KNOWN TONOMETER WAS INVENTED BY SCHEIBLER IN 1834, AND WAS SUBSEQUENTLY IMPROVED BY KÖNIG. IT CONSISTED OF AN EXCEPTIONALLY PERFECT SET OF TUNING FORKS WITH AN APPEARANCE FOR DETERMINING THE EXACT NUMBER OF VIBRATIONS PER SECOND PRODUCED BY A GIVEN TONE. AN INSTRUMENT FOR MEASURING TENSION IN A LIQUID, OR OF THE EYEBALL, IS ALSO TERMED A TONOMETER.

TONQUIN. SEE TONKIN.

TONSILS AND TONSILITIS. SEE NOSE AND THROAT, DISEASE OF.

TONSON, JACOB, ENGLISH PUBLISHER: B. LONDON, 1656; D. THERE, 2 APRIL 1736. IN 1678 HE OPENED HIS SHOP AT THE JUDGE'S HEAD, CHANCERY LANE. HIS WORKS INCLUDED THOSE OF THE PUBLISHER OF DRYDEN'S WORKS, AND CONTINUED IN SUCH AS MANY YEARS. IN 1690 HE COMPLETED THE PURCHASE OF THE PUBLISHING RIGHTS OF 'PARADISE LOST,' AND AFTERWARD CLAIMED THAT HE MADE MORE ON THIS WORK THAN ON ANY OTHER. ABOUT 1700 HE REMOVED HIS SHOP TO A PLACE IN GRAY'S INN GATE. WHEN THE KIT-CAT CLUB (Q.V.) WAS FOUNDED HE WAS MADE ITS SECRETARY. HE PURCHASED A HOUSE AT BARN ELMS AND PROVIDED A ROOM THERE FOR THE MEETINGS OF THE CLUB. IN 1710 HE MOVED TO THE SHAKESPEARE'S HEAD. HERE HE CONTINUED UNTIL HIS RETIREMENT FROM BUSINESS IN 1720. HIS NAME IS ASSOCIATED WITH NEARLY ALL THE LITERARY MEN OF HIS TIME; WITH POPE, WHOSE PASTORALS APPEARED IN TONSON'S 'MISCELLANY,' (1709); WITH ADDISON, FOR WHOM HE PUBLISHED 'CATO' (1713) AND FOR A TIME ISSUED THE SPECTATOR; WITH CONGREVE, STEELE, WALLER, ETC. WYCHERLEY SPOKE OF HIM AS HAVING LONG ACTED AS GENTLEMAN-usher TO THE MUSES. HE PUBLISHED ROWE'S EDITION OF SHAKESPEARE (1709).


TONTINE, tōn-tīn', A FORM OF ANNUITY OR FINANCIAL ASSURANCE IN WHICH GAIN ACCRUES FROM SURVIVORSHIP. THE NAME IS DERIVED FROM THE NAME OF LORENZO TONTI, A NEAPOLITAN WHO SETTLED IN PARIS IN THE TIME OF CARDINAL MAZARIN AND WHO INVENTED THIS STYLE OF LIFE ANNUITY. TONTI PROPOSED THE SYSTEM TO THE FRENCH GOVERNMENT AS A METHOD OF RAISING FUNDS WHILE THE PLAN WAS NOT ADOPTED, STILL IT SERVED AS A MODEL ON WHICH ALL FUTURE TONTINES WERE OPERATED. THE MEMBERS OF TONTI'S ASSOCIATION WERE TO SUBSCRIBE THE SUM OF MONEY NEEDED BY THE GOVERNMENT AND TO RECEIVE LIFE SHARES IN THE SOCIETY. THERE WERE TO BE 10 CLASSES OF SUBSCRIBERS, ACCORDING TO THEIR AGE, AND FOR EACH CLASS A FIXED SUM WAS TO BE DIVIDED YEARLY AMONG THE MEMBERS OF THE CLASS. WHEN A MEMBER DIED HIS SHARE WAS DIVIDED WITH THE REST AMONG THE MEMBERS OF THE CLASS SO THAT THE DEATH OF EACH MEMBER BENEFITED ALL THOSE REMAINING, AND THE PROFIT TO THE LAST FEW SURVIVORS IN EACH CLASS WAS ENORMOUS, WHILE THE SOLE SURVIVOR RECEIVED THE ENTIRE SUM OF INTEREST ACCRUING TO HIS CLASS. UPON HIS INTEREST CEASING AND THE BORROWER OBTAINING THE CAPITAL. IN 1689-92 THE SYSTEM WAS USED BY LOUIS XIV, WHO WAS SOLELY IN NEED OF FUNDS. HE ORGANIZED A TONTINE WITH A CAPITAL OF $70,000,000, WHICH LASTED FOR A PERIOD OF 40 YEARS. THE SOLE BORROWER FOR AN ANNUAL INTEREST OF $367,500 FROM HIS ORIGINAL INVESTMENT OF $1,500. DURING THE FOLLOWING CENTURY THE TONTINE WAS FREQUENTLY USED IN FRANCE AND IN GREAT BRITAIN, AND IN AT LEAST ONE INSTANCE IN THE UNITED STATES, IN ORDER TO RAISE LARGE SUMS OF MONEY. A DISASTER PRIVATE TONTINE IN FRANCE, KNOWN AS THE "CAISSE LAFARGE," WAS ESTABLISHED IN 1791. WHEN 60,000,000 FRANCS HAD BEEN SUBSCRIBED INTO THE COMPANY IT WAS FOUND THAT EITHER THROUGH GROSS ERROR OR FRAUD THE INTEREST PROMISED WAS AN IMPOSSIBLE ONE AND THE SUBSCRIBERS Owing TO THE FINANCIAL PANIC THEN PREVAILING LOST NOT ONLY THEIR INTEREST BUT THEIR CAPITAL AS WELL. THE LAST PUBLIC TONTINE IN ENGLAND WAS OPENED IN 1789 AND THE INTEREST, AMOUNTING TO $210,150, WAS PAID AS LATE AS 70 YEARS AFTER THAT DATE. THE IRISH TONTINES, ESTABLISHED 1773-77, DREW AS MANY AS 3,500 MEMBERS. TONTINES IN THE UNITED STATES WERE AT ONE TIME POPULAR AS A MEANS FOR RAISING MONEY FOR THE ELECTION OF LARGE QUINQUENNIAL TAXES. THE NEW YORK TONTINE SOCIETY, FOUNDED IN 1790, WAS WOUNDED IN 1870-78, WHILE TONTINE BUILDINGS WERE ERECTED IN NEW YORK, NEW HAVEN, ALBANY AND OTHER AMERICAN CITIES.

ALTHOUGH TONTINES IN THEIR OLD FORM WERE LONG AGO ABANDONED BY FINANCIERS, THE TONTINE SYSTEM AS APPLIED TO LIFE ASSURANCE HAS GIVEN RISE TO AN IMPORTANT MODIFICATION OF THE USUAL INSURANCE POLICIES. WHAT IS KNOWN AS THE TONTINE DIVIDEND POLICY HAS THE FOLLOWING DISTINCTIVE FEATURES: THE HOLDERS OF SUCH POLICIES CONSTITUTE A CLASS BY THEMSELVES; THEY DO NOT PARTICIPATE IN PROFITS UNTIL AFTER THE LAPSE OF THE TONTINE PERIOD, USUALLY 10, 15 OR 20 YEARS; THE REPRESENTATIVES OF THE INSURED IN CASE OF HIS DEATH BEFORE THE COMMENCEMENT OF THE DIVIDEND PERIOD RECEIVE ONLY THE SUM MENTIONED AS THE FACE VALUE OF THE POLICY; NO SACRED VALUE IS ALLOWED TO ANYONE WHO RELINQUISHES HIS POLICY BEFORE THE DIVIDEND PERIOD AND ALL PROFITS FROM WHATSOEVER SOURCE ARE RESERVED UNTIL THAT PERIOD, WHEN THE ACCUMULATED DIVIDENDS ARE TO BE
equitably divided among the holders of such policies as are then in force. This form of policy has been practised by various societies. For further information consult F. De Pesster's 'History of the Tontine Building' (1855). See INSURANCE.

TONTO (Spanish, 'foolish'), an inappropriate name applied by the Spanish colonists of Arizona in the 19th century to a number of Indian tribes, namely: (1) To the Tukalpa, a tribe of the Yuman stock settled in 1875 on San Carlos reservation, Arizona. (2) To the Eyo-tero Apaches, an Athapascen tribe. (3) To the Papago of the same stock. (4) To a mixture of Yavakai (Yuman) men and Pinal women who had intermarried. The name has been especially applied to a well-known body, the former occupied Tonto Basin and the Pinal Mountains of central Arizona, where some 500 of them were removed to the Rio Verde reservation and later to the San Carlos reservation. They number about 700, and speak a mixed Yuman-Athapascan language.

TONTY, tonté, or TONTI, Henri de, French explorer: b. about 1650; d. Fort Louis (Mobile), September 1706. He was a son of Lorenzo Tonti. He entered the French army, served also in the navy, and in 1678 came with La Salle (q.v.) to Canada, went with him into the Illinois country in 1680, undertaking the first civilized occupation of that region, and was placed in charge of Fort Crèvecoeur, a little below Peoria, where La Salle left him. In 1681 he joined La Salle at Michilimackinac, and with him descended the Mississippi to its mouth. Subsequently he was in command of the stronghold called "Starved Rock," by La Salle Fort Saint Louis, and in 1688, after La Salle's death, unsuccessfully attempted the rescue of the French colonists left in Texas. "There are very few names in French-American history," says Parkman, "mentioned with such unanimity of praise as that of Henri de Tonti." He wore a metal band with which he so effectually disarmed the Indians on occasions that they thought him a god. Consult French, 'Historical Collections of Louisiana' (Vol. I, 1846); Parkman, 'The Discovery of the Great West' (1849; new ed., 1898).

"TOO PROUD TO FIGHT," an expression used by President Wilson in the course of an address delivered to 4,000 newly-naturalized American citizens in Convention Hall, Philadelphia, on 10 May 1915. Torn from its context, this now historic phrase accumulated a large amount of more or less intentional misinterpretation. The sentence immediately following it contains the real gist of the President's meaning: "There is such a thing as a man being too proud to fight. There is such a thing as a nation being so rich that it does not need to convince others by force that it is right.

TOOLE, Utah, county-seat of Tooele County, on the San Pedro, Los Angeles and Salt Lake and the Tooele Valley railroads, 45 miles southwest of Salt Lake City. The industries include a large smelter, a flouring mill, saw mills, and a creamery. It has a Carnegie library. Pop. about 3,400.

TOOKIE, John Horne, English polychist and philologist: b. Westminster, 25 June 1718; d. Wimborne, 18 March 1812. He was educated at Westminster and at Eton, whence he was removed to Saint John's College, Cambridge. In 1756 he entered himself as a Inner Temple; but in 1760 he took orders. He was a warm opponent of the American war and was prosecuted for sedition for the working of a resolution by which the Constitution Society voted £100 to the widows and children of the Americans "murdered by the king's troops," in the battle of Lexington. For the anonymous paragraph he was in 1777, and sentenced to a year's imprisonment and a fine of £200. In 1780 he published a keen review of Lord North's administration, in a pamphlet entitled 'Facts,' and in 1782 a 'Letter on Parliamentary Reform.' It was in 1782 that he took the name of "Tooke," being previously known as John Horne. This came about through his being named as heir to William Tooke, a wealthy gentleman of Surrey. In 1786 he published in a quarto work entitled 'Epea Pteroenta' (Greek for 'Winged Words'), or the 'Divisions of Purley.' In 1801 he accepted the seat for Old Sarum. His political life closed with the dissolution of Parliament in 1802. Tooke possessed considerate learning. His 'Epea Pteroenta' is original and ingenious, and has exercised considerable influence on the subsequent development of philological investigation.

TOOLE, John Lawrence, English comedian: b. London, 12 March 1832; d. Brighton, 30 July 1906. He was educated at the City of London School. After he was tried at the Old Bailey for a wine-merchant's clerk he took to the stage, and made his first appearance at the Haymarket in 1852. He then played with great success in Dublin, Belfast, Edinburgh and Glasgow, and ultimately became a popular favourite everywhere. In 1880 he began the management of the Folly Theatre, London, which he afterward reconstructed and named after himself. In 1874 he visited America, and in 1888 he published his 'Ruminiscences,' and in 1890 made a successful tour in Australia. He was one of the most popular actors on the stage, inimitable in his personation of semi-pathetic, semi-ludicrous characters. Among his most successful parts were Paul Pry, Caleb Plummer in the 'Cricket on the Hearth' and Uncle Dick in 'Uncle Dick's Darling.' One of his latest parts was that of Walker in Barr's 'Walker, London.'

TOOLE, Joseph Kemp, American lawyer and state executive: b. Savannah, Mo., 2 May 1831. He removed to Montana, became established as a lawyer in 1870, and served two terms as district-attorney. He was a member of the Territorial legislature in 1879, and of Congress, 1884-88. He was elected to the Constitutional Convention in 1889, was the first governor of the new State of Montana in 1889-93, and was re-elected governor in 1900 and 1904 but resigned 1 April 1908; and retired into private life.

TOOLS. The almost innumerable variety of mechanical appliances and devices which are included under the general term "tools" may be primarily classified into three important groups...
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or the portion of a structure is truly horizontal or truly perpendicular.

Plumb-level.—This is a cord attached to the exact center of the upper end of a vertical straight-edge. A weight suspended from the lower end of the cord swings freely in a pear-shaped hole near the lower end of the straight-edge. A straight line is marked on the straight-edge from the center of the pear-shaped hole to the point of attachment of the cord. In testing the perpendicularity of a surface, one edge of the straight-edge is placed against the surface under test and the coincidence of the cord with the line marked on the straight-edge is carefully noted.

Gauges.—Three common kinds of gauges are used in carpentry work—the marking gauge, the cutting gauge and the mortise gauge. The marking gauge consists of a head or block which slides along a shank about nine inches long. A spike is inserted near the end of the shank and the movable head is provided with a screw or a wedge by which it may be fixed at any required distance from the spike. It is used for the purpose of making a mark on a piece of wood parallel to an edge which has been previously straightened and along which the head of the gauge is guided while the spike inflicts the mark. It is very useful in dressing several pieces of wood to exactly the same breadth. The cutting gauge is similar to the marking gauge in all respects with the exception of the spike which is replaced by a thin steel plate. This plate passes through the shank and is held in place by a set-screw and is sharpened on one edge so that it is capable of cutting either with or across the grain. It is used for gauging dovetailed work and for cutting veneers to equal breadths. The mortise gauge is also similar to the other two gauges but it is provided with two spikes, one fixed and the other movable and capable of being adjusted at different distances from the fixed spike by means of a set-screw. It is used for the purpose of gauging mortise and tenon work. Compound gauges consisting of combinations of cutting and marking gauges or of marking and mortise gauges are also commonly used for the purposes designated.

Bevels.—These are made somewhat like the squares, but with the exception that the blades are attached to the stock by a pin which permits of their being set at any angle other than a right angle, and held in such position by a thumbscrew; they are used for the purpose of marking lines at such angles to the first side of the piece of work. In some forms the blade is slotted through a part of its length and is called a sliding bevel. Others such as the boat-builder's bevels have two brass blades, one at each end of the stock, while in the protractor bevel the sliding arm works through a semi-circle graduated into degrees.

Mitre-box.—This is a device for guiding a saw so that it will cut at some regular angle, as 45 degrees. In its simplest form it is a rectangular box composed of two equal pieces of solid wood, fastened to the bottom. A saw-cut made at an angle of 45 degrees through the sides guides the saw when it is employed to cut a piece of wood such as a picture molding placed in the mitre-box. One of the most important things is to understand that those at an angle of 45 degrees may be marked in the same box by cutting the guiding cuts at the
required angles through the sides of the box. The most convenient form of mitre-box for cutting a wide series of angles is one provided with movable guides which may be readily set at the required angles. As a rule, the mitre-edges of the moldings are left rough from the saw so as to make the glue adhere more firmly, but where sawed mitre-work requires to be planed smooth it is planed up with a "shooting-board" which consists of two pieces of wood screwed together so as to form a step, on the up-sloping outer side of which two strips of wood are screwed at right angles to each other. These strips act as guide-bars against which the piece of molding to be mitred is held and then planed off on the edge of the step.

**Compasses and Calipers.**—These devices are made of metal and are employed for the purpose of taking dimensions such as the inside and outside diameters of pipes and other cylindrical work that cannot be taken accurately with a rule. A compass consists of two long parallel thin needles which slide in a brass or iron joint. In the form called a "wing-compass," it is provided with a metal arc and a set-screw attachment which permits of its being set to correspond with a definite measurement and remain so without adjustment until that particular measurement is no longer required. Compasses are also used for striking-out circular figures.

**Calipers** are termed "inside" and "outside" calipers according to the character of the dimensions taken by their aid. Inside calipers are made with straight legs which are bent around only at the point and are used for measuring internal diameters. Outside calipers are made with bowed legs and are used for taking measurements of external diameters. "Combination" calipers are an improved form in which the legs are pivoted near the middle point, thus making four movable ends, two of which are bowed and are used for taking outside measurements, and the other two straight and applicable to the taking of inside measurements.

**Clamps.**—These are appliances in the form of beam-compasses in which the heads slide along a straight bar to which they may be tightened by set-screws. The heads are made either of brass or of hard wood, the former being red and the latter inserted into the bodies. They are employed for the purpose of taking measurements and for striking areas which exceed the capacity of the ordinary compasses.

**Caliper-rules and Caliper-squares.**—The caliper-rule consists of a short steel rule, a portion of which is attached to a closely-fitting slide which may be drawn out until the object to be measured is embraced between the opposing portions of the rule. As both the rule and the slide are graduated into minute fractions of an inch, the thicknesses of the objects measured can be read off directly from the dimensions on the slide. The caliper-square is a square, one edge of which is fitted with a caliper-rule.

**Bell Centre-punch.** This is a useful little device, by the aid of which a square, round, oval or triangular article may be instantaneously and accurately centred for the purposes of drilling and turning. It consists of a punch which is enclosed within a tube; the lower end of which is expanded or tapering into the shape of a bell. This tapering mouth adapts bars of different diameters, and when over the end of a bar of any cross-section ever ensures the marking of the exact length of the bar by the point of the punch.

The holding tools are represented by various forms of pincers, vises and clamps. Pincers.—These consist of various implements shaped somewhat like tongs with a long handle to which are riveted two jaws, one of which is immovable and the other movable. Pincers are used for holding work when the need of gripping is rare. Vises.—These are made in a great variety of forms and sizes, the most useful are those with parallel movement in which the vise-jaws are adjustable. The ordinary vise consists of a pair of jaws one of which is capable of being moved by a screw or by a lever, while the fixed rigidly. The improved form is provided with swivel-laws and swivel-arms, which move the vise-arms to any position that may be required. Vises are usually steel-faced, and the preliminary tightening them to a vise they are first secured by the wrought-iron backing and serrated for the purpose. The vises are usually welded to the backing which is commonly known as the "taper." The loose jaw-piece rounded on the back and capable of movement in a corresponding hole is attached to the fixed jaw. The sliding movement by which the vise is adapted to different angles for holding the form of tapered work. Vise-clamps are simply angle strips of sheet copper, which are placed against the order to prevent the bruising of the metal work by the serrations on the faces.

**Clamps.**—These comprise several appliances for holding together pieces in position for nailing and screw tightening up the joints in glued wood to allow sufficient time for the glue to set. An ordinary form consists of a lever and two brackets which slide together. The buckets are capable of being moved to any point on the bar while the operation of turning the screws is provided with a series of holes in the sliding bracket may be held in the desired point. Some of the types are the adjustable "screw-clamp," the latter being a very useful for securely gripping two sides of a frame while they are being nailed together.

The rasping tools comprise the rasps, files and rasps.

The Saws are an important...
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...neyed for cutting and dividing substances. meral, the saw may be defined as a tool g a serrated blade and furnished with idly from the point to the tooth. "Gauge," for this purpose is a useful device for d h" or "rake," the inclination or angle of ace of a tooth. This varies from 65 de to 70 degrees for cutting soft woods and 80 degrees to 85 degrees for cutting hard s or the set of the teeth is formed by the base and top of the tooth from 45 degrees to 50 degrees for soft s and from 65 degrees to 70 degrees for woods. "Gullet" or "throat," the depth of both from the point to the root. "Gauge," hight of the saw. A gauge may be obtained by the wire-gauge. "Set," the amount of t inclination given to the teeth to one side other of the blade for effecting clearance of the sawdust. "Points," the er of teeth points to an inch, taken as a in estimating the coarseness or fineness of t. The teeth of cross-cut saws are usually ed to cut both ways. Saw teeth are design by various names such as "peg" teeth, teeth, "half-moon" teeth, "gullet" teeth, according to their peculiar form. The us kinds of saws commonly used by wood-e are the "hand-saws," the "back-saws," "frame-saws" and the "pad-saws." The "deal," "frame," "band" and "circular" are mostly used in connection with the action of lumber and sawmill-work. See ; AND SAWING in this Encyclopedia.

Files and Rasps.—These comprise a class ols having surfaces covered with sharp f burrows or teeth, which are employed for ing particles of wood, metal or other ma by the process of abrasion or the cutting of a multitude of fine points. They are in a vast number of shapes and sizes and i degrees of fineness or coarseness to them to various kinds of work and tials. A file differs from a rasp in that its ws or teeth are made by straight cuts in l on its surface by a reciprocating chisel e the metal is hardened, either in a series nge cuts or crossed cuts, while the teeth rash are a number of isolated projections on its surface by the pyramidal end of sangular punch. See FILES AND FILE MAK this Encyclopedia.

Age Tools comprise the various forms of s and gouges, the planes and a miscel- us assortment of spokeshaves or smooth-soles and various appliances such as grind s, emery wheels and oilstones, used for aiming a sharp cutting-edge on the various s and Gouges.—The essential principle these types of cutting tools is that of wedge. The chisel in its simplest form ically constitutes the slice of an axe, but as its action or movement is the result of the force applied to it by the blows of a mallet or hammer, the eye of the axe is replaced by a suitable device for driving the blow and the element of thrust enters into the operation of a chisel, as in the cases where it is used by the simple pressure of the hand, its action passes into that of the plane iron. Chisels are specifically defined as "chipping," "cross-cut," "firmers," "pairing" and "mortise" chisels. The firmer chisels are the ordinary short chisels used by wood-workers and are so designated in order to distinguish them from the paring chisels which are usually about twice the length of the firmer tools and are almost exclusively used by patternmakers. Paring chisels are seldom driven with the mallet, but are actuated by hand pressure alone. They are made in width ranging from one-fourth inch to two inches. The mortise or the chisel which is driven with a mallet and used for cutting mortises where percussion and leverage are rendered necessary. The gouges are forms of paring and firmer chisels which have curved cross-sections. The cutting-edge of the paring gouge is formed by grinding its inner face and that of the firmer gouge by grinding its outer face. Gouges vary in width from one-eighth inch to two inches. The paring gouge differs from the ordinary firmer gouge in its increased length. It is never driven with the mallet, but is applied with a thrusting motion of the hand and is used chiefly by patternmakers for cutting the various curved outlines of their work. It will be observed, that as a rule, the chisel cannot be satisfactorily used over a surface wider than itself, and, therefore, the gouge was devised in order to obtain a tool of greater utility for that purpose. In practice this advantage is partially realized, but there still remains quite a tendency on the part of the gouge to follow the grain of the wood instead of cutting through the fibres at a very slight inclination. All gouges are held and used in the same way as a paring chisel, but if any occasion demands the driving of a gouge with a mallet, it should always be held in a perpendicular position.

Spokeshaves or Drawing Knives are essentially two-handed blades which can only be used by being pulled toward the operator. The general form consists of a long, narrow, chisel-edged blade the ends of which are attached to two handles which stand at right angles to the blade. These handles are of wood and the "tangs" into which the ends of the blade are prolonged are bent around at right angles to the blade and pass right through the handles and are riveted over brass plates at their ends, in order to prevent the blade from being drawn out of the handles when it is drawn toward the workman against the resistance of the wood. These tools are used for cutting thick and heavy chips off the rough edges of boards so as to decrease the amount of the work required in the planing operations and they are also used by patternmakers for the cutting of sweeping curves or "sweeps" in work where great accuracy is not essential. Router planes are provided with cutters of varying forms and are effectively used for chamfering, rabbeting and other similar purposes.

Planes.—In its simplest form the plane con-
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consists of a chisel-shaped plane-iron, so-called, though made of steel, placed at an angle in a "stock" or box of wood or metal in such a way that the cutting edge projects slightly through the bottom of the box. It derives its value from the guidance imparted to the cutting edge and the support of some part of the box. The plane is operated by being pushed forward, over the surface of the material being worked, so that the cutting edge bites into the fibre and removes a thin shaving which slides upward along the upper side of the plane-iron and is thus discharged from the hollow of the box. The depth of the cut or the thickness of the shaving removed may be regulated by raising or lowering the plane-iron, which is usually held in place by means of a wedge or by a screw, and is, therefore, capable of being adjusted. The plane-irons are made both single and double. In the latter case, the back-iron is introduced for the purpose of breaking the shaving so as to reduce the amount of cumulus. The correct continuity of the surface of the fibre of a long shaving. Planes in which double plane-irons are used are called "built-up" planes. There are at least a hundred different kinds of planes in use at the present time, but all of them may be grouped into three general classes—the "jack-planes," the "trying-planes," and the "smoothing-planes." The jack-plane is the first plane used for roughing down the timber received from the hands of the sawyer or from the saw-mill. The cutting-edge of its plane-iron is more curved than that of the other planes and consequently takes coarser and narrower shavings. The trying-plane is used after the jack-plane for producing the greatest accuracy attainable in the surfaces of wood by hand. It is usually about 22 inches in length and carries a plane-iron about two and one-half inches in width. The cutting-edge is sharpened perfectly straight transversely, and this, combined with the length of the plane, enables the workman to produce very true surfaces by its use. The smoothing-plane is a small plane used for imparting a smooth finish to surfaces in work where extreme accuracy is not essential. It is made about eight inches in length and is designed to carry plane-irons ranging from four inches to one inch in width, and about four inches in width. Some of the more useful and important special forms of planes are the "rabbet," or "rabbeting," plane, employed for making window frames and other similar work in which a rabbet or recess is required to be cut for the reception of the edges of a glass plate or other material; the "plow," employed for cutting a deep groove along the edge of a board for the reception of a corresponding tongue formed along the edge of an adjoining board, and the "stop-chamfer," plane, employed for cutting any chamfer or bevel-edge ranging from one-eighth inch to one and one-half inches in size, with a constant angle. Grindstones, Emery Wheels and Oilstones. The sharpening of the cutting-edges of chisels and plane-irons is performed first on a grindstone or on an emery wheel and then finished to a fine edge on an oilstone. Grindstones are shaped so that when turned into circular form and are made of varying diameters. They are usually arranged to revolve in troughs containing water, but they ought not run actually in the water as that would soften them and cause them to wear equally. The water should be fed onto a drip-can. They are revolved by a handle attached to the axe and make about 20 revolutions per minute. Oilerstones are used for ordinary tools. Various forms of rests and supports have been devised for holding during the process of grinding, but in the use of woodworking tools they are seldom the workmen usually preferring to hold tools by hand against the edge of the stone. Grindstones are "trued" or "turned" by hand by means of a pointed bar of which is constantly rotated during the operation so as to always present a new cutting edge to the stone and they are "trued" most by means of a threaded roller of steel is clamped in a frame and allowed to revolve against the surface of the stone. Such planes are called "grindstone truers." A number of wheels are sometimes used where the full edge of the grindstone is too coarse, but made of powdered emery cemented together or of emery cemented to a wooden centrepiece. The cementing material usually employed is a silicate insoluble in water and the wheels are usually made in about 10 inches in diameter than grindstones and operate at a higher rate of speed. Emery itself is a mixture of corundum composed of oxide of alumina, silica and a small proportion of potash. The oilstones, sometimes called "hones," are essentially fine-grained natural stones which are used for producing the final edge on tools by the process of abrasion, with a steady water to assist the process. They are usually set in wooden stocks and provided with covers to protect them from dust and wear. The principal varieties are the Turkey, Charnley Field, the Arkansas, the Granite and the Wadhurst stones. As a general rule oilstones will wear away the most in the middle and become hollow both in the diameter and breadth. Sometimes, as the case of the sharpening of jack-plane in this hollowing out is somewhat of an advantage, and is imparted a desirable curvature to the edge, but when it is required to have the surface of the stone is very easily rubbed o a flat sandstone or on a slab. Gouges and head-planes are used sharpened by means of oil-slips on slips of oilstone about six inches long and inches broad and ranging from one to one-half inch in thickness, the edges are rounded in a transverse direction on the hollow faces of the tools. Boring tools for wood comprise the forms of awls, gimlets, augers, bits and the drills. Awls or bradaws are the simplest form of boring tools and are used for preparatory work for the admission of nails and screws. The ordinary form of awl consists of a rod one end of which is fastened to a handle and the other end double-hevelled sharp V-shaped edge by which the fibre of the wood may be compressed and parted so as to form a hole with a screwing chips. The greatest drawback in the ordinary form is the tendency of the steel rod to p
the handle when the tool is withdrawn from the hole it has made in the wood. This is especially the case when working in hard woods. In the superior forms this fault is remedied by the use of a hollow handle which contains a number of awls of different sizes, each of which may be fastened to the handle by means of a screw-nut.

Gimlets are of awl-form plus a screw. It consists of a small steel rod, one end of which is attached to a wooden handle which forms a T with the rod, and the other end is shaped into the form of a screw. This end consists of a point in the form of a taper screw and a spiral groove which extends partway of the stem or body as in the case of the "twist-gimlets," or the body may be hollowed out into a nearly semi-cylindrical shell as in the case of the "shell-gimlets." The commonest forms are called "spikes," while other forms are designated as "triple-twist" gimlets, "auger" gimlets, "patent-twist" gimlets and "brewers-twist" gimlets, according to the shape of the spiral body. A distinct movement of these tools are usually required by a wood-worker.

Augers are merely large gimlets. They are made in both the twisted and the shell forms and are operated by both hands by means of a wooden bar thrust through the eye at the handle end of the stem. Their sizes increase one-eighth-inch at a time from three-eighths-inch to two inches in diameter.

Bits and Braces.—The bits comprise the various forms of boring tools such as "centres," "shells," "gouges," "countersinks," etc. They are actuated by the "brace" or "stock." These tools were developed in order to overcome the faults inherent in all forms of awls, gimlets and augers, due to the interruption of the continuous rotation of those tools necessitated by the change of the position of the hands and by the limited amount of pressure applied to the tool. The stock or brace consists of a crank, one end of which is provided with a round head for receiving the pressure of the breast of the operator and the other end recessed for the reception of the bit. In the earlier forms the bit was secured in the receiving end of the brace by means of a thumb-screw which engaged a notch near the end of the bit seventh part way down of the compound tool. This defect has been remedied in the later forms by the use of various kinds of expanding devices or expanding-chucks which adapt themselves to all shapes and sizes of stems and hold the bits securely and truly in place. The centre-bit comprises the centre-point, nicker and cutter attached to a shank. The nicker and the cutter are actuated by the brace and rotate about the centre-point. It is used for boring large and deep holes. The countersinks are made in a great variety of forms and are designated as "snail-horn," "rose-head" and "flat-head" according to the shape of the cutting point. In wood work they are employed for enlarging the entrances of holes or to dress the heads of screws or bolts lie close enough to the surface of the wood. Some of the other useful forms of bits actuated by the brace are the "screw-driver" bit, the shank end of which is square-tapered to fit the socket of the brace and which being turned with the brace is quicker in its action than that of a hand-worked screw-driver; the "taper" bit for boring funnel-shaped holes; the "shell" bit, the cross section of which is composed of a convex and concave curve roughly semi-circular in form; the "nose" bit, a shell bit provided with a nose or lip at the cutting-point for the withdrawal of the core from the wood; the "spoon" bit, the cutting-edge of which is formed in the shape of a parabola and, therefore, does not draw out the core as effectually as the nose bit; and the "gouge" bit, the cross-section of which is similar to that of the gouge used is simply rounded at the cutting-point without the provision of a nose or lip. In the ordinary forms of the compound tool the brace is rotated through complete revolutions, thus preventing the boring of holes or the driving of screws in one side of a corner at a distance any closer to the adjacent side than that which is equal to the radius of revolution, but this shortcoming of the tool is remedied in the hatchet brace in which the brace acts as a lever which keeps the amount of the same time feeds it forward by means of a ratchet and click actuating a square-threaded feed-screw, as the brace is moved back and forth through partial revolutions.

The striking tools comprise the various forms of hammers and mallets.

Hammers.—Ordinarily, a hammer consists of two parts—the iron or steel hammer-head, and the shaft or handle of wood which is driven into a hole in the centre of mass of the hammer-head. The angles at which the handles are attached to the heads vary greatly on account of the variations in the position of the centre of gravity of the head relatively to the line of the penetration of the handle, and also on account of the various convexities of the faces of the hammer-head. The form of the "pane" or the narrower or smaller end of the hammer-head also varies greatly in the hammers used for different purposes. When of hemispherical form as in the engineers' hammers, it is called a "ball" pane; when it is made in the form of a narrow, round-edged ridge placed at right angles to the axis of the handle it is called a "cross" pane; and when the ridge runs longitudinally it is called a "straight" pane. In the claw-hammers the appreciable part of the handle toward the handle and is divided by a V-shaped groove, and the head is usually attached to the handle by means of side flanges. It is very useful for drawing nails. The hand hammers used by wood-workers range in weight from one-half ounce to 10 pounds. The weight of the head and the balance of the head in the handle are the most important considerations determining the suitability of a particular hammer, for if the handle is too light for the head will break off.

Mallets.—These are forms of hammers in which the metal heads are replaced by wooden blocks. They are practically heavy wooden hammers which are used for delivering blows on the handles of chisels and gouges in order to avoid the risk of the latter being split by the blows. The ram of iron hammers are used for that purpose. Round-faced wooden mallets are used by molders for rapping patterns in order to detach the sand which adheres to them when they are drawn.
from the molds. Woodworkers' mallets are either square or round in form. The square mallets are about six inches in length and two by wood-workers range in weight from one-half inches in width. The round mallets are about five inches in length and three inches in diameter. The mallet-heads are usually made of hickory wood, and sometimes of lignum vitæ.

The chopping tools are the axes, the hatchets, and the adzes. In each case they represent the combination of a striking tool and a cutting tool. In these tools the shape of the hand or helve and the manner in which it is attached to the blade is of the utmost importance in governing their effectiveness.

Axes and Hatchets are edged tools with handles used in chopping for rough cutting or splitting. They vary mainly as to the weight of the blade, to the shape or curvature of the handle and to the form of the cutting-edge. Axe blades range in weight from two to seven pounds. These blades are usually made by welding the hard tempered steel portion which forms the cutting-edge to the iron portion which contains the "eye" provided for the reception of the handle. The curved form of the handle tends to counteract the influence of the force of gravity which tends to twist the blade downwards when the axe is used for chopping at various obliquities. The form of the cutting-edge, curved horizontally, and wedge-shaped transversely to the sides of the blade, is designed for the purpose of separating the groups of wood fibres successively, and for equalizing the pressure of the blow on each side of the blade. A hatchet is a light form of axe, with usually a nail-pulling groove back of the blade.

In the adze, the cutting edge stands transversely or at right angles to the handle, which is quite short. The entire outer face of the blade is made slightly curved, and its cutting-edge is formed by beveling from the inner face. It is usually employed for the forming of lengths of wood into curved shapes.

**Metal-Working Tools.**

The almost innumerable variety of metal-working tools and the great variety of purposes for which they are employed make the classification into a series of general groups practically impossible within a limited space. In a general work they may be conveniently divided into various classes according to the character of the work to which they are applied. Such a method of classification would group the main body of metal-working tools under foundry work, forge shop work and machine shop work, the last named including all the turning, gear-cutting and tool-making tools and appliances. The greater number of these are treated under their special headings in the several volumes of this Encyclopedia, and as in the case of the wood-working appliances, the various kinds of machines employed in the metal-working industries are not specific treated but included in the major headings under the title METAL-WORKING MACHINERY. The larger metal-working tools are known as machine-tools, including all those machines that operate cutting tools for shaping metal, such as lathes, power-drills, boring-drills, shapers, milling machines and the like.

The elementary descriptions of the various forms of small tools such as the guiding tools, the holding tools, the rasping tools, the cutting tools, the drilling tools and the striking tools already given in connection with the wood-working tools will be found applicable to similar tools employed in metal working, subject, however, to the modifications demanded by the greater hardness of the material worked, and the greater accuracy of execution required in the finished products of some classes of metal work. In the main these modifications consist in the employment of finer and harder materials in the making of the tools, in the particular forms given to the cutting edges and in the methods by which the tools are applied in the execution of the work.

The guiding tools employed in metal work are quite similar to those already described and comprise the various forms of rules, squares, straight-edges and calipers, all made of metal, and also the various forms of micrometer calipers which is employed for making adjustments for wear. For this purpose, the nut is closed onto the screw by being advanced on the stem toward the yoke. The shell or thimble on which the graduations are marked is attached to the end of the screw and rotates with it, and moves along over the shank of the yoke. A screwing arrangement for rapidly advancing the screw is provided in the form of a knurled-nut in the yoke which is also capable of contracting a bushing over the measuring stem so as to lock it in any desired position. The measuring point and the opposing anvil are carefully ground so as to make their faces perfectly parallel with each other. These micrometers are usually provided with a screw having 40 threads to the inch and with the barrel graduated to 10ths and 40ths of an inch. By this arrangement one revolution of the screw advances the thimble one division on the barrel, equal to one-fortieth of an inch, and as the circumference of the thimble is divided into 25 equal parts, twenty-fifth of one revolution of the screw advances the measuring point one-twenty-fifth of one-fortieth, equal to one one-thousandth of an inch. By the aid of the vernier attachment applied to the barrel measurements as small as one ten-thousandth of an inch are readily obtained.

**Gauges and Indicators.**—These tools are employed for indicating the sizes of wire, machine-screws, drills and plate thicknesses. Various systems of gauges are employed, in all of which the dimensions are purely arbitrary. The American or Brown and Sharp gauge was adopted to produce a gauge to overcome the irregularities in spacing of the Birmingham gauge. In this gauge the dimensions increase by regular geometrical progression, the largest dimension No. 0 being equal to 0.46 inch and the next smaller dimension, No. 000, being obtained by multiplying 0.46 by the constant 0.90522, each smaller number being the product of the preceding number and the constant. Gauges for indicating the gauge of wire or plates are of two forms — the angular and the
notch gauges. Other forms of gauges are the "centre" gauge which is used for gauging lathe and machine centres in turning and grinding work; the "screw-thread" gauge used for gauging the threads; the "screw-pitch" gauge used for determining the pitch of screw threads; the "depth-gauge" used for measuring the depth of holes and recesses; the "scratch" gauge used for ruling lines parallel with the edge of a piece of work and several forms of "surface" gauges which are principally used in determining the parallelism of the surface of a piece of work with the machine table, housing or other plane of reference. They are also used in testing, erecting and in the setting-up work on machine tools.

Test indicators are a class of tools or instruments used for determining small irregularities in the accuracy of cylindrical surfaces and small variations from the true rotation of such surfaces. They are also used in determining the inaccuracies of a plane surface and in measuring small amounts of end or lateral motion such as the end-motion of a spindle. They are of two types—those which merely indicate the presence of looseness or those which give a reading or measurement showing the exact amount of the errors.

Some of the other small tools indispensable to the metal worker may be briefly summarized as follows:

The various forms of "hack-saws" used for severing purposes. They are made of hardened steel to cut metal and mounted in a light frame and may be operated either by hand or by some form of power. Their blades are usually made with 14 teeth to the inch for general work and with 25 teeth to the inch for cutting tubing and thin metal.

The "monkey-wrench" and other forms of wrenches used for screwing and unscrewing the nuts of screw-bolts, etc.

The various forms of "drills" and especially the modern "twist-drill" which is universally used at the present time and which has completely supplanted the old flat forged drill which for many years held the first position as a tool for producing circular holes in metal. "Drills" which comprise a class of fluted tools used for finishing and truing bored or drilled holes. They are solid when used in a socket or with a wrench and shell or hollow when bored out to fit a mandrel.

The "screw-threads," "taps" and "dies," which, according to their use, may be divided into two classes—those used for fastenings and those used for communicating motion. There are three forms of screw threads used for fastenings—the "V" thread in which the sides make an angle of 60 degrees with each other and in which the top and the root are sharp; the "United States standard" thread which is similar to the "V" thread with the exception that the top is cut off and the bottom filled in; and the "Whitworth" or "English standard" thread in which the top is rounded off and the root filled in and in which the sides form an angle of 55 degrees with each other. There are also three forms of screw-threads employed for communicating motion—the "square" thread, the "trapezoidal" thread and "Powell's" thread.

The top is used for producing internal threads and the die is employed for cutting external threads. They are of two kinds—those operated by hand and those operated by power-driven machines. Hand taps and dies are in sets, each of which comprise three taps—the "taper-tap," the "plug-tap" and the "bottoming tap." The taper-tap is parallel on the point for a distance equal to one-fourth the diameter of the tap and this point is made the diameter of the roots of the teeth and corresponds to the correct size of the hole to be tapped so as to produce a full thread. In the plug-tap the first three teeth are tapered off and in the bottoming-tap the teeth extend full to the point. The taper-tap is used for starting a thread, the plug-tap for extending it nearly to the bottom and the bottoming-tap for finishing the full thread to the very bottom of the hole.

The dies may be divided into two general classes—those which have to be passed over the work several times in order to produce a finished thread and those by which a finished thread is produced at a single cutting. In the former, the cutting-dies are held in a stock and are capable of being opened so as to permit of their being passed over the work and then closed, by means of a set screw, an amount sufficient to enable them to cut a full thread. In the latter, they are not of the screw-plate type, the "chasers" or "feathers" are held radially in a cast-iron "collet" surrounded by a wrought-iron ring. These dies are capable of being adjusted to compensate for wear. The bevelled outer ends of the chasers fit into corresponding bevelled grooves in the wrought-iron ring so that when the ring is forced down the chasers are moved toward the centre. A great variety of self-opening and adjustable dies are also used for machine threading.

MASONRY WORK TOOLS.

The masonry work tools may be conveniently divided into two general classes—stonemasons' tools and bricklayers' tools. Those employed by either of the two classes of workmen are neither numerous nor intricate in design. The principal tools of the stonemason are the saw, the mallet, the scrabbling hammer and the various forms of chisels designated as the "inch-tool," the "boaster" and the "broad-tool," which are distinguished by their size, the first being one inch, the second two inches and the third three and one-half inches in width.

In the work of stone cutting, the preliminary operations are performed by a small chisel called the "point" and the finishing work executed by the use of the others in turn according to their size. The principal tools of the bricklayer are the various forms of trowels, the plumb levels and the bricklayers' hammers. For further information relative to the various forms of stone-cutting saws, see SAWs AND SAWING; STONE-CUTTING AND DRESSING; and also the articles under the titles Files and File Making; Metal-Working Machinery; and Wood-Working Machinery in this Encyclopedia.

TOOMBS, Robert, American lawyer and statesman: b. Wilkes County, Ga., 2 July 1810; d. Washington, Ga., 15 Dec. 1885. He was the son of a Georgia planter, attended for one year Franklin College (now the University of
TOON — TOOTH-ORNAMENT

(Georgia) and was graduated at Union College, Schenectady, N. Y., in 1828. In 1829 he studied law at the University of Virginia and in 1830, being under age, was admitted to the bar by special act of the legislature. Within 10 years he became one of the foremost lawyers of Georgia. In 1836, when the Creek War broke out in Alabama, he raised a company of volunteers and served as captain under Gen. Winfield Scott. In 1837-40 and 1842-43 Toombs was a member of the legislature and during this time became a leader of the State Rights Whigs of Georgia. From 1844 to 1852 he served as representative in Congress and was one of its best orators and debaters. In 1850 he was a prominent supporter of the compromise measures in the House. In 1852 with other Southern Whigs he refused to support Scott for President. After 1852, like Stephens, he acted with the Democrats. From 1853 to 1861 he was in the United States Senate. In 1854 he favored the Kansas-Nebraska Bill as carrying out the principles of the compromise of 1850. Immediately before the election of 1860 Toombs lectured in the North on slavery. After the election of Lincoln he advised secession of the Southern States and made secession speeches in Georgia in December 1860 and in the United States Senate in January 1861, maintaining that in secession lay the only hope of security for the South. Georgia seceded 19 Jan. 1861 and Toombs withdrew from the Senate four days later. In March he was formally expelled. He was chosen to the Confederate Provisional Congress that met in Montgomery in March 1861 and by a considerable minority was considered as a candidate for President. On 21 February he was made Secretary of State by President Davis. He opposed the firing on Sumter that began the contest of arms. Resigning September 1861 to become a brigadier-general in the Confederate army, he fought with distinction in the second battle of Manassas (Bull Run) and at Sharp'sburg (Antietam). He resigned his commission in 1863 and in 1864 was made a major-general of the Georgia militia. He disapproved the policy of the Richmond administration and personally disliked Davis. With Vice-President Stephens and Governor Brown he headed the Peace Movement in Georgia in 1864, sending a message to the people of the South on the cause of the Confederacy. In 1865, to escape arrest, Toombs went abroad, visiting Cuba, France and England. Returning in 1867, on the restoration of the privilege of habeas corpus, he soon amassed a fortune of $500,000 in the practice of law. In 1872 he was a member of the Georgia Democratic Convention and supported Horace Greeley for the Presidency. In 1874 the Georgia legislature passed a law providing that railroads should be taxed like other property. The railroads resisted, and Toombs, taking the case of the State, won the suit in the courts and collected all back taxes. For 10 years he continued the struggle to force the railroads to pay taxes and give proper service to the public and in 1877 secured the passage of a law providing that railroads in the Southern States have since passed the model after the Georgia law.

In the eyes of Toombs he was considered examples and reared a four children. His friends thought him a statesman of the first order and were disappointed that he made no higher mark. His handy temper hindered his career in politics. In the army he was an able general, but not a disciplined subordinate. He belonged to the school of Jefferson in politics, believing in strict construction, State sovereignty and strong local government, with much liberty for the individual. His political theories were meant for times of peace, but he could not stand the strain of war; consequently he was at variance with the Confederate administration from the beginning. As long as he lived Toombs never ceased to denounce the Reconstruction measures of Congress. His experiences from 1863 to the end of Reconstruction caused him so to dislike the United States government that he refused to ask for a pardon or to take the oath of allegiance and he never again had the privileges of citizenship. Consult Stovall, 'Robert Toombs, Statesman, Speaker, Soldier, Sage' (1892); Trent, 'Southern Statesmen of the Old Regime' (1897).

West Virginia University.

TOON, or TOONA, a tree (Cedrela toona) of the family Meliaceae. It is a native of India and Australia, being found at altitudes of 400 feet on the Himalaya Mountains as well as near tide-level. In the former country it is one of the largest trees; in the latter, it often exceeds 150 feet in height and 18 feet in circumference. Hooker mentions a specimen of India 10 feet in diameter at five feet from the ground. The tree is cultivated for its timber and flowers. The wood is soft, open-grained, easily seasoned and worked, little liable to warp and easily polished. The heartwood is reddish and resembles mahogany and veneers taken from the roots or where branches join the trunk are said to be remarkably handsome. The chief uses of the wood are in house-building, furniture-making, carving, etc. Under the names bastard cedar, bastard white cedar and Moulmein cedar the wood is an important export to English markets. The bark is very astringent and is used for leather which usually is pulpish from a dye also present. The flowers yield a reddish yellowish dye which is in common use in India. A close relative of this tree, C. serrata, is grown in the United States as a tree, where its leaves and berries are cultivated in California and the Gulf States. It is not hardy in the colder parts of the country. See Mahogany.

TOOTH-BILLED PIGEON, a large fruit-pigeon (Didunculus strigirostris) of Samoa, formerly called "Dodlet" under the erroneous impression that it was a surviving relative of the dodo. It is about 14 inches long; body rounded, head orange, with the lower mandible deeply cleft into three distinct tips near the tip. Head, neck, breast and abdomen glossy greenish black, rest of back black and under coverts deep chestnut. It is an native.

TOOTH-ORNAMENT, a decoration peculiar to medieval architecture, consisted of row of fluted flowers, the centres of which pre
ject in a point. These are used in series, either in a continuous row or at slight intervals, and are generally inseparable. They are used in great profusion in the Early English architecture, forming one of its characteristic features, and in some of the richer suits of molding the flowers are very thick and the series is repeated several times.

TOOTH-SHELL. See DENTALIUM.

TOOTHCHE, a pain in a tooth or adjacent gum or in a tooth causing the gum to be sore. The most common cause is decay of some portion of the tooth, admitting air to the nerve, which causes sharp pain. If there is a considerable opening it is colloquially called "jumping toothache." The pain may be stopped by application of oil of cloves on cotton and closing the passage that admits air; if oil of cloves is not to be had diluted chloroform on cotton is a good substitute; cresote is also used, especially in a gum styled toothache gum. But the pain and decay will usually continue unless the services of a dentist are sought. Decay in the root of a tooth often generates gas, which induces a pressure on the nerve, and consequent toothache. The remedy is to bore a small hole into the tooth and release the gas. If this is not done the gas forces itself through the gums, often with severe pain, resulting in a gum-boil. This is not a true boil, but a hole formed through the flesh by the pressure of the gas. When this finds a vent there is some relief, but a permanent cure involves treating the tooth by a dentist. Neuralgic toothache is a purely nervous variety, and may occur either in sound or carious teeth. It comes and goes suddenly in paroxysms, and is accompanied by little or no swelling. As a preventive against toothache the teeth should be kept scrupulously clean, and when they show symptoms of decay the services of a skilful dentist should be secured. The decay of a tooth is arrested by stopping up the cavity.

TOOTHACHE TREE. See ARALIA.

TOOTHED HERRING. See MOONEYE.

TOOTHPICK, a small pick for removing substances lodged in the teeth. The ordinary toothpick is of wood about the size of a friction match, but longer and slenderer and pointed at one end or both. The use of wooden toothpicks has become very common in the United States and many millions of the tiny wooden slivers are manufactured there every year. The seat of this industry is in Maine, near the forests of white birch, which wood is chiefly employed in their making. The telling of "toothpick trees" is not a separate business but one incidental to the Maine lumbermen. After a tree has been felled the branches are lopped off and only the trunk is sent to the mills. There the bark is skimmed and the naked trunk inserted in a hold or molting box of the thickness of toothpicks and as wide as a toothpick's length. These sheets, known as "veneers," are run through another machine which in one operation cuts them into toothpicks ready for shipment. Of the better grades white by quality, or "tears," are separated. Toothpicks are made every year from Japan and from Portugal. The Portuguese toothpicks are made of orange-wood and are smaller but tougher, better shaped and more finely pointed than the domestic picks.

The Japanese make their toothpicks from fine reeds, which they shave down to the thickness of paper, retain their form and pliability. Metal toothpicks, as of gold, which were formerly common, are now little in demand since their use endangers the enamel of the teeth. Quill toothpicks, cut from the shaft of a hen's feather, are still considerably used.

TOOTHWORT. See DENTARIA.

TOOWOOMBA, too-woom'ba, Australia, a town of Queensland, in the center of the state, 100 miles by rail west of Brisbane, on an elevation known as the Great Dividing Range. It has a number of churches, two colleges and other educational institutions, and a fine new municipal building. There are flour-mills, saw-mills and a brewery, and in the neighborhood are vineyards. Pop. about 11,000.

TOP-MINNOWS, a group of small, robust minnows, represented by Gambusia patruels of the brackish waters along the Atlantic Coast, which are distinguished by their habit of swimming and feeding near the surface. See MINNOW.

TOP-SHELLS, the Turbinidae, a family of gastropod mollusks, mostly tropical and oriental, in which the shell is usually turbinate or top-shaped, but may be pyramidal. It is generally nacreous internally. The operculum is horny, and may exhibit a spiral form. In the genus Turbo the shell is top-shaped with a rounded base. The whorls are convex, and the aperture is large, the operculum being calcareous. The genus Trochus also belongs to the top-shells. In the latter genus the shell is pyramidal and the base flattened, the operculum being horny. The common top is the T. echinatus. Others are the T. versicolor, the T. imperialis and the T. miloticus. After having been ground and powdered to exhibit the nacreous inner layers, they are extensively sold as ornaments.

TOPAZ, a mineral having the composition of an aluminum fluo-silicate. It is not the topaz of Pliny and other early writers which was chrysoleite (q.v.), the names having been interchanged. It generally crystallizes in orthorhombic prisms, colorless, white, yellow, or occasionally pale green or blue. Transparent topaz, in any of its tints, is a beautiful gem. The colorless variety much resembles diamond, and is sometimes sold for it, though its lower hardness (8) affords an easy test. What has been called the largest diamond in the world, among the Crown jewels of Portugal, is probably a colorless or "white" topaz. The yellow variety is most familiar, and is called "Brazilian topaz," in distinction from "Oriental topaz" (yellow sapphire) and "false," "Scotch" or "Spanish topaz" (yellow quartz). The "Oriental topaz" is much rarer, harder (9) and denser (about 4); while the "Spanish topaz" is cheaper, less hard (7) and lighter (2·65), the density of topaz being 3·4 to 3·6. It is also distinguished by its eminent basal cleavage. The favorite shade is wine-yellow or sherry-color. Both yellow and blue topaz fade and become white by weathering, or exposure to light, and some yellow varieties can be changed to a pale pink by heating, yielding the so-called "burnt topaz" or "Brazilian ruby," resembling the pale, or Balas, variety of ruby spinel (q.v.).
Topaz occurs usually in metamorphic rocks, like gneiss, but also somewhat in igneous rocks. Tonality, and topaz, are not always associated with tin-ore. The principal localities are in Ceylon, Siberia, Japan, Brazil and Mexico. In the United States it occurs in large masses at Stoneham, Me., and Trumbull, Conn.; in crystals in Colorado and Utah. Fine topaz crystals, colorless and pale blue, have recently been found in San Diego County, Cal.

**TOPAZOLITE**, a variety of andradite garnet having a light yellow or pale grayish green color. The most beautiful specimens are found in the Alava Valley, Piedmont, Italy. They also occur in California.

**TOPEA**, a Buddhist monument intended for the preservation of relics. The oldest monuments of this kind are spherical or elliptical cupolas, resting on a circular or rectilinear base, with an umbrella-shaped roof, and sometimes with a series of roofs of this form which develop into a spire, pyramid, or other architectural form. In the interior is a cell or chamber for containing the box with relics; but in some cases no relics have been found, and it is supposed they have been buried underground. The Sanskrit name is **stupa**, mound, from which is derived thupa and tope, meaning top. The older topeas are masonry mounds, the cupola top and ornamental roofs and spire forms being later developments for ornamentation. Some of them are of great architectural beauty, rising tier above tier, with a series of graceful "parasol" roofs, the limit of height being about 300 feet. But the typical construction is that of The Great Tope at Sanchi, in central India. This is a hat-shaped mound or dome 42 feet high and 106 feet at the widest point. The flat space on top was for the chhatra or umbrella-like apex. This being the royal emblem. This was like a substantial parasol, as if to guard the relics from the weather. The Great Tope is surrounded with a magnificently carved stone railing, leaving an empty ornamental entrance or gateway, over 30 feet high. The chamber or cell in which the relics were kept was generally built with an outer construction of masonry; often enclosing a bronze bell which again encased Christ's Body. It stood as a case and within this perhaps a casket of gold containing the relics which it was desired to preserve. The number of stones in the topeas often indicate Buddhist symbolism—three, seven and 11 being the numbers rich in meaning. Topeas are common in the Orient and there are groups of conspicuous ones at Amravati, Sarnatti and Telalad in Bengal, at Sattahara and Somari in central India, at Abayagiri, Ruanwalli and Tampamaya in Ceylon. Relics of kings and great men were thus cared for, much as we build statues and monuments today. See DAGOBA; PAGODA.

**TOPEKA**, Kan., city and county-seat of Shawnee County, capital of the State and the third largest city in the State, on both banks of the Kansas River, on the Atchison, Topeka and Santa Fe Railway, 90 miles west of Chicago, 300 miles west of New York, 900 miles west of Philadelphia, 1,300 miles west of Saint Louis, 1,400 miles west of Denver, 1,500 miles west of Salt Lake City, 1,600 miles west of Los Angeles, 1,700 miles west of San Francisco, 1,800 miles west of Portland, 1,900 miles west of Seattle, 1,800 miles west of San Diego, and 2,000 miles west of Los Angeles. It is on a branch of the Kansas River, which is dammed at Topeka to form Lake Shawnee. The city is laid out with broad streets crossing at right angles and beautifully shaded. Topeka was settled by people from the "Free State" in 1854; an anti-slave constitution was adopted here in 1856 known as the "Topeka Constitution" and the "Topeka government" was established by national authority. It was incorporated as a city in 1857 and selected as the State capital in 1861. The principal industries are the railroad shops of the Atchison, Topeka and Santa Fe Railway, printing plants, six flouring mills having a capacity of 5,000 barrels per day, creameries, packing-houses, foundries, machine shops, boiler works, preserving works, silo factories, engine works and planing mills. According to the United States census of manufactures of 1914 Topeka had 159 manufacturing establishments with a combined capital of $14,186,000, employing 5,721 persons, paying $3,691,000 in wages and manufacturing a product valued at $20,000,000. Topeka has 10 banks, three of which are national banks and three building and loan associations with assets of $9,000,000. Topeka is an important jobbing centre, there being four wholesale groceries, six wholesale commission houses, wholesale hardware, paper, drugs, groceries, and an orphans' home and chief railroad centres between the Missouri River and the Pacific Coast. The State capital, a handsome stone edifice, is the most important building of the city. The State Memorial building, erected to the memory of the veterans of the Civil War at a cost of $350,000, is the most handsome structure in the city. The government building and the court house are also creditable buildings. Topeka has a municipally owned city building with a handsomestorium annex with seating capacity for 5,000 people. Just west of the city, two miles, is the State Hospital for the Insane; the State Re form School is located just north of the city about three miles. The Colored Industrial Institute is a coeducational institution for colored boys and girls located just east of the city. Orphans Home—two Crittenden Homes, one each for the unfortunate white and colored girls, the Provident Association Building, the Inglewood Home for Old Ladies, a Methodist Home for the Aged are among the most notable of its charitable institutions. The Santa Fe Railroad maintains its own private hospital and the public hospitals are Saint Francis and Saint Luke's Hospitals. The city has a free public library, a well-organized public school system, including a high school established in 1874; an excellent manual training school is also maintained. It is the seat of Washburn College, a coeducational institution for men and women, and the College of the Sisters of Bethany and three business colleges. Topeka has the commission form of government, having a mayor and four commissioners; a well-equipped fire department and an excellent police department. The city owns its own electric light and water plant. The cost of city government as reported by the United States government reports for the year 1915 shows $20.71 per capita as spent in Topeka for the maintenance of city government. The physical valuation of Topeka is about $54,000,000. The area of the city is 16 square miles. Topeka has over two miles of ornamental lighting system, has 240 acres of city-owned parks and play grounds. Pop. 22,250.

**TOPELIUS, to-pé-le-oos, Zacharia, Finnish author:** b. Kuddnäs, near Nykarleby, 14 Jan.
TÖPFER — TORBERT

1818; d. Helsingfors, 13 March 1896. He was graduated at the University of Helsingfors in 1842, studied theology at Helsingfors and Uppsala, in which many of his earlier writings were first printed, and held at the university the chairs successively of Finnish history (1854–63), of the history of Finland and the monastic regions (1863–66), and of general history (1876–79). After Rupenberg (q.v.), he is the chief poet of Finland. His religious and patriotic lyrics are particularly valued. Among the collections of his verse are 'Flowers of the Heath' (1845–54); 'New Leaves' (1870). He wrote also several dramas, such as 'After Fifty Years' (1851), and works of fiction, including 'A Surgeon's Stories' (1853–67), a cycle based on Finnish and Swedish history from the time of Gustavus II Adolphus, to that of Gustavus III. There are German translations of several of his writings and an English version of the 'Surgeon's Stories' has appeared in the United States (1883–88).

TÖPFER, Rudolph, Swiss novelist: b. Geneva, 1799; d. there, 1846. In 1832 he became teacher of aesthetics at the Academy of Geneva and in 1839 his novel 'Le presbytère' attracted general attention to him and ensured his position in the world of letters. He was a voluminous writer and won renown for his 'Voyages en zigzag' (1848) which were continued with illustrations by himself in 1853. Among his best productions is 'Le Voyage en Zigzag' (1848), his little novel in pictures which were published together in Geneva, 1846–47. Consult Wolterstoff, Hermann, 'Essai sur la vie et les œuvres de Rodolph Töpfér' (Magdeburg 1894).

TOPHET, or TOPHETH, a locality described in Scripture as in the valley of Hinnom, near Jerusalem, where high places were erected, and which was the chief seat of the worship of Moloch, with its fiery human sacrifices and abominations. The good King Josiah suppressed that form of idolatry, and made Tophet a receptacle for the refuse of Jerusalem. Afterward it became a burying-ground. It was shunned with horror by the Jews, and the word has come to be used by Christians as the synonym of a place of punishment after death. The origin of the word is doubtful. It is derived by some from Hebrew toph, a drum, in allusion to the drums beaten to drown the cries of children burnt in the fire to Moloch, and this seems a probable interpretation. Another derivation is from an Aramean word signifying to spit or vomit, in allusion to the disgust created by the place. Consult 2 Kings xxiii, 10; Jer. vii, 31–32; Isa. xxx, 33.

TOPIC, the subject of a discourse, whether written or spoken; the matter treated of in conversation, argument, oration, literary composition, etc. In rhetoric and logic topic was restricted to the narrower sense of a common ground or point, from which other arguments may be started: one of the various general forms of argument employed in probable reasoning, as distinct from demonstrative reasoning. In medicine the word is usually more to denote any remedy locally applied; it is, however, frequently used in the plural, topics, denoting the class of such remedies, than applied to any one specific.

TOPLADY, Augustus Montague, English theologian and hymn writer: b. Farnham, Surrey, 4 Nov., 1760; d. London, 11 Aug., 1778. He was educated at Westminster and Trinity College, Dublin, and in 1768 was presented to the vicarage of Broadbent, Devonshire. Though a voluminous writer — and a strenuous defender of Calvinism against John Wesley — Toplady is now hardly known except as the author of the hymn 'Rock of Ages,' one of the finest expressions of evangelical faith and fervor to be found in all hymnology.

TOPOGRAPHICAL SURVEYING. See Surveying.

TOPOLOBAMPO BAY, Mexico, a small bay of the Gulf of California on the west coast of the state of Sinaloa. It is noted on account of the attempt made in 1886 by a number of Socialists of the United States to form a co-operative community on its shores. A company was chartered, in which all the colonists were stockholders, and which was to own all the land, and conduct all the business of the community. Everything was to be done as far as possible on the socialist plan as described in Bellamy's 'Looking Backward.' Several hundred colonists joined in the experiment, and a city was surveyed and laid out on an elaborate plan. The experiment, however, was a failure, largely owing to aridity of the land and the absence of available streams for irrigation. The place was abandoned in 1891.

TOPPHONE, an instrument for determining the direction from which any sound proceeds. It is valuable for use at sea, during fog, or in the night, to determine the direction of a sounding bell, fog-horn, whistle, etc. The topophone was invented by A. M. Mayer, and consists of a centrally pivoted horizontal bar having at each end resonators, with their openings facing the same way, each with a connecting sound tube for the ears of the observer. In use the bar is turned until a position is found in which the sound is loudest and equally distinct in each ear. The location of the sound is at a right angle to the bar in the direction to which the resonators face.

TORAH, or THORAH. See Pentateuch.

TORBANE, or THORBANITE, a lustreless variety of canal coal, especially rich in volatile matter formerly used in the manufacture of illuminating gas, paraffin and lubricating oils. It occurs at Torbane Hill, near Bathgate, Scotland, but the supply is exhausted. See Boghead Coal.

TORKEL, or TÖRFEND, Alfred Thomas Archimedean, American soldier: b. Georgetown, Del., 1 July 1833; d. at sea off the coast of Florida, 20 Sept. 1880. He was graduated at West Point in 1855, was engaged on frontier duty in Texas, Florida, New Mexico and Utah in 1855–60, and in 1861, and led his regiment in the Peninsula campaign of 1862; was assigned to the duty of mustering in volunteers. He was commissioned colonel in 1861, and led his regiment in the Bull Run and in the battles of
South Mountain and Antietam. He was promoted brigadier-general of volunteers in 1862; commanded a brigade at Gettysburg in 1863; for gallantry he was breveted major in the regular army; in April 1864 was transferred to the cavalry service and placed in command of the 1st division of the Army of the Potomac. He commanded the cavalry in many subsequent engagements, including those at Anse Hotten, Milford, Winchester and Waynesboro. In 1864 he was brevetted major-general of volunteers, attaining the same rank in 1865 in the regular army. In 1866 he was mustered out of the volunteer service and resigned his regular army commission. He was United States Minister to the Central American States 1869-71, was transferred as consul-general to Havana, Cuba, and in 1873-78 was consul-general in Paris. He was lost in the foundering of the Vesta off the coast of Florida.

TORCELLO, tor-chel’o, Italy, an island in the lagoon of Venice, six miles above the city. It is the see of a bishop and possesses an ancient Byzantine cathedral of Santa Maria of the 7th century, with mosaics of the 12th century, curious altar-benches, an antique crypt, octagonal baptistery from 1008 and a bellry; Santa Fosca is another handsome church with a fine interior (12th century). Pop. 130.

TORDENSJOLD, Peter, Norwegian naval officer; b. Trondhjem, 1691; d. 1720. He endeared himself to the people by his exploits in the navy to which he was appointed a lieutenent in 1716 was given a noble rank for his victories. But in 25 years of age he destroyed the Swedish fleet of 44 ships and compelled the raising of the siege of Fredriks- hald by Charles XII. He was made vice-admiral (1719) for the destruction of the principal Swedish squadron.

TORGAU, to’r-gow, Germany, a town in the province of Saxony, Prussia, on the Elbe, 32 miles northeast of Leipzig. Prior to 1889 it was a fortified town, and has considerable historical significance in connection with (1) the Alliance of Torgau, a confederation formed in 1526 by Saxony, Hess, and other German states in which Protestantism united for the purpose of defense against aggression on the part of their antagonists; (2) the Articles of Torgau, a declaration by Luther and his supporters in 1530, which was the foundation of the Augsburg Confession; (3) the battle of Torgau, fought in the suburb of Lautitz, 3 Nov. 1709, when the Prussians under Frederick the Great defeated the Austrians under General von Daun; (4) the siege of Torgau by Turenin in 1814, the city holding out for three months and surrendering 10 Jan. 1814. The Renaissance Harten- fels Castle of the 15th century was a former electoral residence. In the town-hall is a museum of Saxon antiquities. There is here a modern fort for the protection of the railway system. The royal stad from is long located in the vicinities. Pop. about 13,000.

TORMENTIL, an old provincial name for various species of Plantago (pav.), a plant applied to yield relief from the torment of laches.

TORNADO, from the Spanish torando, "a turning about," the local name given in various tropical and subtropical regions, notably Sene- gal, to violent whirlwinds or cyclones, with the usual accompaniment of electrical disturbances and downpouring rain. See CYCLONE; METEOROLOGY; WIND.

TORNADO ALARM, an apparatus which automatically gives an alarm when there is a sudden change of atmospheric pressure, such as precedes a tornado. It is a form of barometer in which the main mercury tube has a cylindrical bulb at the top and is bent in the form of a siphon. Near the lower portion of the shorter member is a secondary tube, the connection being made by means of a short tube connecting with the main tube by a very small opening. The fluid in both the larger tubes will remain normally of equal or nearly equal height in ordinary changes of the weather, but in case of sudden atmospheric changes the small opening in the connection between the tube restricts the movement in the secondary tube as compared with that in the main tube. Such variation in the movement of the mercury in the two tubes when sufficient to indicate an approaching storm, is made to give an alarm by means of floats in the tubes connected with wires in an electric circuit, there being on one wire a fork and on the other a tongue, by which contacts are made, to ring an alarm when the points meet. This alarm should sound some two minutes before the first blasts of the tornado. Ordinary storms have no effect on the apparatus.

TORNEA ELF, tor-ne’-ə elf (sometimes written Torné), Sweden, a river at the north which rises in Lake Tornea. Part of its course forms the boundary between Sweden and Finland, and then empties into the Gulf of Bothnia after a course of 275 miles. The town of Tornea stands at its mouth and on the opposite side of the river the Swedish town of Haparanda.

TORONTO, Canada, a city and lakeport: the capital of the province of Ontario, situated on the circular Toronto Bay between the mouths of the Don and Humble rivers, on the northwest coast of Lake Ontario, 313 miles west-southwest of Montreal and 60 miles in a direct line northwest of Buffalo, United States. It is the seat of the provincial government, of the higher law courts, of an important university and of the Department of Education of the province; it is also the cathedral city of a Roman Catholic and of an Anglican diocese. In commercial importance it is the second city in the Dominion, and, after Montreal, the chief railway centre. The Grand Trunk, the Canadian Pacific, and many branch lines connect it with the principal cities of Canada and of the northern United States, and it is the headquarters of the Canadian Northern and the Timiskaming and Northern Ontario Railway. The fine harbor, five miles long and one and a half wide, is formed by a long, low, sandy island, protected by imposing breakwaters; the island is, in summer, a favorite bathing and boating resort. A great scheme of development, which includes the deepening and extension of the harbor, land reclamation, boulevard construction and the creation of industrial sites is in progress. The city rises gradually from the water's edge to a height of 220 feet; it extends from east to west for about 10 miles along the lake shore and from north to south from three
View of the Centre of the City
miles, and covers an area of about 32
niles, with streets crossing each other
angles. An electric street railway sys-
about 144 miles, and some 5,000 per-
specialty of the numerous public build-
tasteful and imposing, and there are
es and shops and residences. Brick of a
ight color, or red, is the chief building
Of the public buildings, the most
most finish that connected with the archi-
ary College, a fine Norman structure in
, with a massive tower and richly
doorway, was rebuilt after partial
on by fire in 1890; the Library, the new
Building, the Biological Department,
of Practical Science, with its hand-
working engineering building in the Renais-
sle, and a number of other large struc-
to this with a make up an imposing
it wholly is a situation, but in a spacious
park land. Adjacent are the "Neo-
Parliament buildings, containing the
ent offices, and a handsome and wel-
legislative hall. The magnificent city
city is like the well-wo
most striking of Toronto's buildings.
worthy of mention are Osgoode Hall,
of the provincial law courts; the Nor-
buildings, offices of the Department
ient; Central Technical School; Trin-
ge, in connection with the Church of
ornate building, in the late Gothic:
custom house, the post office, the exhi-
buildings, where an important an
is held, and the lunatic asylum, in
acres of ground. A new Union rail-
ion to cost $5,000,000 is in course of
.es most worthy of the Roman Catholic and Anglican
s, both in the pointed style; the latter
 specimens of Early English.
c numbers theatres and many public:
 chief being the Massey Music Hall, II
0,000 or 5,000 people. Toronto
 acres of park, the chief being Queen's
ming the university, and the extensive
k of the city. It is a
essional centre. The university (see:
article) is one of the best equipped
ac. Educational institutions connected
College (already men-
College (Methodist, arts and
; Knox College (Presbyterian, theo-
Wycliffe College (Anglican theolo-
Michael's College (Roman Catho-
colleges for instruction in music, den-
marmacy and veterinary science. Its
all college is situated not at Toronto but
h, Ontario. McMaster University is
Baptist institution, teaching arts
hat is Upper Canada College, in spa-
s, is a residential school for boys,
, Saint Andrew's College, the site of
 acquired in 1917 for a military hos-
veral College is a similar type of
, or girls, and besides it are Bishop
School, Saint Margaret's College,
 Conservatory of Music has
number of pupils. The observa-
which the weather reports for the De-
re made up, is in the university
Toronto has suffered from destruc-
tive conflagrations, notably in 1849, in 1890 and
in April 1904, when more than 100 buildings in
the wholesale business section were burned
down, some 533 persons lost their
property, and about $11,000,000 worth of
was destroyed. The industries of Toronto in-
clude a great agricultural implement factory,
iron foundries, shipbuilding, rolling stock, dis-
tilling and brewing, pork-packing, the manu-
facture of soap, tanning, aeroplanes, etc. The
city possesses a well-equipped system of public
libraries, with a fine reference library centrally
located, in which the John Ross Robertson his-
torical and ornithological collections are housed.
Shipping on the lakes is laid up in winter,
but during the navigable season several lines of
steamers connect with the principal ports on the
Great Lakes and the Saint Lawrence. The
lake commerce in lumber, grain, coal, cattle
and fruit is large. Toronto's bank clearings in 1917
were $3,004,785,565; customs revenue, $35,732-
400. The city has over 1,700 manufacturing estab-
lishments, employing 80,000 hands.

The name Toronto is derived from the Huron word, signifying "place of meeting." In 1749, when the French estab-
lished forts or posts through all the West and
down the Mississippi Valley, Fort Rouillé was
founded, on a site even then often called Fort
Toronto. In 1756 this fort, on the west side of
the present city, was destroyed to prevent its
falling into the hands of the English. In 1793
Governor Simcoe finding Niagara or Newark,
which lay almost under the guns of an Ameri-
can fort, too close to the frontier for the seat
of government, removed the capital to the other
side of Lake Ontario and established his head-
quar ters in a tent, on a site in the eastern part
of the present city. In 1813 Toronto, called
York by Governor Simcoe, was captured and
partially burned and looted, twice in the same
year, by the American army and navy. In the
first capture the American General Pike, the
discoverer of Pike's Peak, together with many
soldiers, was killed by an explosion. In 1834
Toronto was incorporated as a city with its
present name. In 1837 it was the chief scene of
a brief and ineffectual rebellion under Wil-
liam Lyon Mackenzie (q.v.). At that time and
often since Toronto has shown itself to be fer-
ently British in sentiment. Its later history
has been purely civic, without other interest than that attaching to prosperous growth. A
pleasant society and an attractive situation make
it a favorite place of residence. Population has
increased rapidly. In 1793, when Governor
Simcoe landed, there were only a few families.
In 1834 the population was less than 1,000. In
1861 it had increased to 44,821, in 1871 to 56-
092 and in 1881 to 86,415. In 1891, including
some annexed suburbs it amounted to 181,220,
and in 1911 to 376,240. Police census (1917),
353,271.

Consult Scadding, "Toronto of Old"; Se-
dding and Dent, "Toronto, Past and Presen-
Adam, "Toronto, Old and New"; and "The
Toronto Annual."

GEORGE M. WEONG,
Professor of History, University of Toronto.

TORONTO, Ohio, village in Jefferson
County, on the Ohio River, and on the Penn-
sylvania Railroad, 10 miles above Steubenville,
the county-seat. It is in a region in which
there are extensive beds of clay and large stone quarries. It is near the natural-gas fields of West Virginia. The chief manufacturing establishments are potteries, brick and tile works. The shipments are chiefly pottery, sewer pipe, terra-cotta and fire-brick. Pop. 4,271.

TORONTO, University of, situated at Toronto, Canada, the head of the educational system of the province of Ontario. The first step toward the establishment of the university was taken in 1797 when the council and assembly of Upper Canada petitioned the king for an appropriation of Crown lands for the purposes of education, and the establishing of a university. The appropriation was made, but nothing further was done toward the founding of the university until 1827, when it was chartered under the name of the University of King's College; the organization of the university was further delayed, largely owing to objections to the sectarian character of its charter, which was amended in 1837; and it was not till 1843 that it was opened to students. In 1849 the name was changed to the University of Toronto; in 1853 the university was further transformed by the organization of two corporations, known as the University of Toronto and the University College; to the latter was assigned the teaching in arts and the entire control of its students. In 1857 a further organization of the education of the whole university took place. Under what is known as the "Federation Act" the university became a teaching body once more, with faculties of arts, medicine, applied science and engineering, to which have been added since, faculties of education, forestry, household science and music. In the faculty of arts the subjects were divided as between the University of Toronto and University College, which may be termed the State Arts College, the complement of the faculty of arts of the university. In this reorganization of the faculty of arts there are now Victoria College, representing the Methodist Church of Canada; Trinity College, representing the Church of England; Saint Michael's College, representing the Roman Catholic Church—so that there are four arts colleges giving instruction in the same arts subjects, but sending their students to the university for instruction in other subjects, among which are mathematics, sciences, philosophy, political science, history.

The institutions which have close relations with the university are either federated or affiliated. Among the federated institutions, outside the arts colleges, are Knox College and Wycliffe College, while among the affiliated colleges are the Ontario Agricultural College, the Royal College of Dental Surgeons, the Ontario College of Pharmacy and the Ontario Veterinary College. These federated and affiliated colleges are represented on the senate of the university, which has charge of the educational policy. Each faculty has its own council and has charge of the discipline and control of its students, while the caput is made up of the chief executive officers of the university together with the heads of the federated colleges.

The university receives a very substantial grant annually from the government of the province of Ontario and is affiliated with the leading universities of Great Britain and Ireland, as well as with the General Medical Council of Great Britain.

The degrees offered by the university include arts, medicine, applied science and engineering, pedagogy, forestry and music, under the regular faculties, while through the affiliated institutions degrees are given in Fine arts, dentistry, agriculture, pharmacy, with diplomas in public health and physical training. Extension summer session work are carried on in the faculty of arts. The university is coeducational and had during the session 1918–19 an attendance of approximately 3,000, which is likely to develop to a greater attendance than in peacetime days, when the enrolment exceeded 4,000.

The important buildings are the main building, convocation hall, the library, household science, the various laboratories and wards. Toronto is the building of Victoria College Trinity College and Saint Michael's College.

TORPEDO, a genus of rays of the family Torpedinidae, most remarkable for their electric organs, which lie on each side of the body. (See Electric fishes.) The electric shock is powerful enough to kill small animals, specimens two or three feet long can be killed by a single discharge. A full-grown man, the family, which includes about seven genera and 15 species, is widely distributed over the Atlantic and Indian oceans; T. marmorata and T. maculata are two others common in the Mediterranean, and T. hemiops reaches the coast of Brazil. The American species T. occidentalis, which may reach a weight of 200 pounds; it is uncommon, is occasionally seen along the coast from Cape Cod to Cuba.

TORPEDO, Automobile. See Automotive Torpedo.

TORPEDO-BOAT DESTROYERS, or Anti-Torpedo Boats.

TORPEDO BOATS. The torpedo boat first made its appearance as an adjunct to the fleet in 1886. At that time its displacement was less than 100 tons, and its speed about 1 knot an hour. From that time on it gradually increased in size and speed, and by 1900 its displacement was about 125 tons and its speed about 23 knots an hour. The next evolution was the destroyer. This new type of vessel became necessary, for the dangerous character of the Agricultural College, for the University College, for the Ontario Agricultural College, the Royal College of Dental Surgeons, the Ontario College of Pharmacy and the Ontario Veterinary College. These federated and affiliated colleges are represented on the senate of the university, which has charge of the educational policy. Each faculty has its own council and has charge of the discipline and control of its students, while the caput is made up of the chief executive officers of the university together with the heads of the federated colleges.

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To be continued.

Provision is made for the undergraduate activities of the men in Hart House, the gift of the Massey Estate. There are men students of the university and for both men and women in University College, Victoria, Trinity and Saint Michael’s colleges.

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To be continued.
TURPEDO DRAG—TORPDEOES

made fast in boats, one on either side of the channel, and as the vessels proceed up and down the channel, abreast, the hooks on the rope below the drag are cut and the torpedo is thrown ahead of a vessel by a small mortar and is drawn in by a windlass; this is to clear the channel through which the vessel must pass.

TORPDEOES. Torpedoes or explosives moving through the water to the object attacked, distinguished from the mine or stationary explosive, first took the form of what was in reality a towed mine. The Harvey, Menzing and the various French towing torpedoes were weapons of this kind. The torpedo was towed astern of a launch with a rig that permitted a rudder on the torpedo being controlled from the towing boat. The torpedo could be guided to a position on the quarter, while a second torpedo was towed astern. By means of a dipping or detaching apparatus, when the wider part of the torpedo touched the target, the torpedo would become completely submerged before the explosion took place. Torpedo warfare received great impetus during the Civil War, various types being developed by both the Confederates and the Federals. Dragging for torpedoes and the use of torpedo nets dropped over the sides of vessels were then first practised, but there appears to have been no use of submarine boats until more recently. During this war the spar or outrigger torpedo came into active use and on more than one occasion during that period and later proved its worth. This weapon consisted of a torpedo carried at the end of a spar or pole which projected from a launch. It was so arranged that just before the target was struck, the torpedo could be plunged below the surface to obtain the holding or plugging effect of the water for the explosion. The explosive usually consisted of about 33 pounds of gun cotton which could be fired upon contact, or at will, by employing a firing battery. To carry and drive home the spar torpedo a fast seaworthy launch or small torpedo-boat was employed.

In its early stages of development, battle ranges seemed logically to keep the torpedo in the background, except at night, when the speedy torpedo-boat counted upon getting near enough to launch its weapons with a more reasonable promise of making a hit. The naval constructor, accepting the torpedo at its potential value as seen by the majority of the fighting officers simply limited his efforts to fabricating the under-body of his fighting craft so that the damaging effects of a chance blow from a torpedo should be confined to a restricted area. Hence the inner bottoms, and the water-tight, cellular division of the intervening space. As a matter of fact, the naval constructor’s work stood up under torpedo attack and performed its function remarkably well. It is a matter of record, that the general run of torpedoes fired during the Russo-Japanese War did far less damage than was expected of them, and a goodly number of vessels so struck were not sunk as was counted upon, but were able to get into port and be repaired. There were ships lost to both belligerents by subaqueous attack, but the most conspicuous of these disasters were due

placing of about 1,100 tons (with a speed of about 32 knots per hour) having been reached and determined by most nations from a consideration of the strategic and tactical duty of the fleet with which it serves. The offensive weapon of the destroyer was originally the gun, but after the torpedo boat disappeared the torpedo became the important weapon and the guns were retained for defense only. The prominent characteristics of the destroyer were high speed, seaworthiness, moderate radius of action and plurality of torpedo tubes and torpedoes. To enhance these characteristics increased size was necessary and this lessened the chance of being able to surprise an enemy on the alert, and surprise was a corollary in its usefulness. These considerations tended to limit the size and when sufficient tonnage for necessary offensive work was gained, no further increase was thought justified. The present tendency is to increase the destroyer's gun power for offensive purposes against the submarine and this brings the destroyer back to the original conception of the use of that type. The latter development will undoubtedly be toward high speed, moderate size, long-range torpedoes, a plurality of small guns and large radius of action. The destroyer, supported by large cruisers, makes an excellent offensive force, especially when armed with long-range torpedoes. Making contact in the daytime with an enemy's fleet, destroyers can, at night, readily slip through the screen and attack the enemy while in its night formation.

The co-ordinated destroyer force becomes an important asset to a fleet when about to go into battle. A well-timed feint upon the battle line of the enemy may give to its own battle line a very important advantage of position. By the intelligent use of a smoke screen, made by emitting large volumes of oil smoke from destroyers' smoke stacks, a battle line in confusion can be rescued from destruction and permitted to reform or to escape. In the battle of Jutland the German fleet was concealed in a smoke screen formed by German destroyers at the time when the main British fleet was about to bring a superior force against it. When the smoke cleared it was observed that the German fleet had extricated itself from danger.

While the first duty of the destroyers was to run down attacking torpedo boats and sink them with the fire of their small rapid-fire guns, it was also armed with torpedo tubes in order that it might be used as an attacking torpedo vessel and to defend the battleships at night. The smaller type of torpedo vessel—the torpedo boat—was classed as a weapon of defense, employed to guard the home coast from raids by the enemy's warships, while the larger was regarded as an offensive weapon, used to destroy the smaller type and allow capital ships to perform, without danger, their duties of blockade and various war measures. See SUBMARINES.

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TORPEDO DRAG, a device for clearing harbors, river-channels, etc., from floating torpedoes and submarine mines. It consists of a long cable, bearing grappling hooks set at frequent intervals. The ends of the cables are
to the violent blows of passive mines. Where the active torpedo had failed in its mission the anchored floating mine filled the offensive gap. These mines carried larger explosive charges than the torpedoes then in service, and proved two things: First, that the naval constructor had planned well; and, second, that the automobile torpedo must needs be made a more powerful weapon if it were to fill the office intended for it. The German Arthur were several vessels that had been built by the French for the Russian government. In addition to the usual compartmenting of the inter-bottom space, the French designers had reinforced the region most likely to be attacked by torpedoes by means of a caisson built of plating nearly two inches thick. The object of this caisson—assuming that the explosion of the torpedo should be sufficient to rend or rupture the plating of the inner and outer bottoms—was to provide more space in which the guncotton gases could expand and dissipate the most dangerous percentage of their remaining force. The ingenious theory of this style of construction proved true all that its originators claimed for it. The Russian ships so built were several times hit by Japanese mines, and while grievously wounded over wide areas of their under-bodies, yet the caissons remained substantially intact and the vessels were able to return to harbor.

The automobile torpedo first came into use in the early seventies. It was the outcome of a series of experiments commenced in 1864 by Robert Whitehead, then superintendent of iron works at Flume, Austria. This torpedo, known as the Whitehead or fish torpedo, claimed the following capabilities: (1) It could be adjusted to run at any depth from 5 to 15 feet when fired from either a submerged or surface tube, or from a surface-detecting apparatus; (2) upon firing, it would make a straight run, provided a proper allowance was made for the deflection due to transverse currents; (3) it could be adjusted to stop at any distance up to its extreme range; and after stopping to sink or float; (4) it could make a run of 1,000 yards at a speed of 15 or 16 knots, while 300 yards could be covered at a speed of 19 to 20 knots; (5) it could carry a warhead holding a charge of 15 pounds of guncotton, to explode upon contact. This torpedo was propelled by a three-cylinder Brotherhood engine weighing 35 pounds, driving two propellers and developing 40 horse power. Eventually the Whitehead torpedo came to be used in the United States service, and later the Bliss-Leavitt torpedo was adopted. As heavier armor was added against torpedo attack a large gap developed which the Whitehead torpedo and its various kindred rivals could not fill, and here it was that the sea came in. Commander Cleland Davis, placed the modern upon a new and more formidable footing. He abandoned the guncotton warhead, which was the accepted instrument of destruction since the invention of the Whitehead, and substituted a water-drowned explosive gun which was water-drowned and could not sink unprotected freight and passenger ships at close range. It is capable of a speed of more than 30 miles per hour and when traveling at normal sea speed. It contains high explosive charge, fired by an air explosion upon the type of torpedo; (2) The air flask, a specially constructed shell of steel, very strongly built to withstand a test pressure of 5,000 pounds to the square inch. This flask carries water at an initial pressure of 2,200 pounds per square inch, the air being used to operate all
echanism of the torpedo in addition to motive power; (3) The depth control
nism, which permits the torpedo to be t and desired depth without surfac
consists principally of a pendulum and a stati
geoscoptic steering gear. The gyroco
compass through the vertical rudder
the torpedo on a course parallel to 1
(5) engines. The air at the high pressure
ounds per square inch first passes through
its range, the effective hits that. In
use of destroyers and battleships, the tor
may be projected from submerged tubes
m deck tubes. In general, torpedoes are
ed from submerged tubes by compressed
d from deck tubes by a small charge of
d\nner, or may be designed to use either powder
pressured air. When the torpedo is fired
a submerged tube the compressed air or
s from the powder follows the torpedo
t the tube with a rush and causes an	on the surface of the sea, which is
for a considerable distance. As a re
us to the warning given by this eruption,
sometimes been able to escape the
oes by a quick manoeuvre. The modern
is self-propelled, being driven through
cooper's agent by its own compressed air motor,
being supplied from a strongly-built
within the body of the torpedo itself.
diers when operated by internal com-
engines as motive power are not trust
. The range of a torpedo is approxi-
a mile, those designed for use on battle-
destroyers being longer ranged than for
use on submarines. The great diffi-
getting proper direction and sufficient
power to give the required speed for a
uration of time renders the long range
practicable. The latest German tor-
range of about 2,000 yards, as the
ded air storage reservoir was reduced
order to increase the charge of high
ive in the warhead. The charge was
0 to 400 pounds. The depth at which
do travel may be regulated to hit the
part of the vessel, and that is usually
feet below the surface. In case of
attack against an armored ship the
be dangerous, should strike be-
armor belt, which usually extends
below the water line. Torpedoes
ually provided with means to cut, more
effectively, through nets placed in their
The detonation of the torpedo is ac-
through a mechanism placed within
head; and if the speed is checked in
motion, the firing mechanism ignites
the heavy charge of explosive
contained within the warhead. It is not neces-
sary to strike a firing pin on the end of a tor-
pedo to detonate the charge. Many sugges-
tions have been made for a torpedo elec-
tically propelled from a ship by means of
flexible cable connecting it with the ship.
This was the first type of torpedo built, but
was discarded for the present dirigible type,
as the weight of cable, difficulties in insulat-
etc., render it of little practical value. The
effectiveness of the Hammond radio-controlled
torpedo is promising. The Board of Ordnance
and Fortifications recommended favorably to
the Secretary of War as to the merits of this
invention, and the Secretary recommended to
Congress that this new type of weapon be in-
stalled in a few of the more important coast
defenses.

When firing a torpedo at a moving target
there are several important factors which
the torpedist must consider. These are the speed
of the target, the course of the target and the
speed of the torpedo itself, all of which factors
must be known within limits in order to make
effective hits. The British and the Germans,
French, Whitehead and Schneider; the Japan-
es and Italians, the Whitehead. In the United
States the Whitehead and Bliss-Leavitt torpe-
does are in general. See Naval Mines; Sub-
marine Mines; Submarines.

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TORQUAY, for-kē', England, a fashionable
watering place in Devonshire, situated on the
south coast, 26 miles northeast of Plymouth,
named from the Tor Abbey nearby, which
was founded in 1196. It is built on a series of
terraces rising from the beach, and is a much
frequented bathing and winter resort. It con-
sists largely of villas and gardens, and has a
fine promenade, public parks, libraries, a mu-
seum, electric light and an excellent water sup-
ply and drainage system. There are manu-
factures of terra-cotta ware, and trade in coal
and marble. The name also applies to the
borough and the Parliamentary division in
which it lies. Pop. of the borough about
39,000.

TORQUE, an ornament of twisted gold or
other metal, worn as a collar or a necklace
by the ancient peoples of Asia and northern
Europe. It consisted of a circle of stiff gold,
twisted except at the ends, which remained
straight or which in some cases were looped
back, so as to overlap. Such collars were con-
sidered a characteristic ornament of the ancient
Gauls and are said to have been so abundant
that about 223 a.c. Flamininus, the general of
Jupiter a golden trophy made from torques of
conquered Gauls. The Torquati, a family of Manilian gens, attribute their name to their ancestor T. Manlius, who having slain a giant Gaul in single combat, was lifted from the neck of the dead body an enormous gold torque, which he ever afterward wore upon his own.

TORQUEMADA, Juan de, hoo-an’ dâ tór-kä mâ-thâ (Latinized form TURRECREMATA), Spanish theologian and cardinal; b. Valladolid, 1388; d. Rome, 26 Sept. 1468. He entered the Dominican order, was graduated at the University of Paris in 1424. After serving as prior at Valladolid and Toledo, he was appointed by Eugenius IV master of the sacred palace in 1431. In 1439 he became a cardinal-priest, later exchanged his title for the cardinal-bishopric of Albano, and still later (1464) for that of Sabina. He gave liberally of labor and money to charities and church-building, and won fame as a theological writer and controverist. He was an influential member of the councils of Constance, Basel and Florence, at the last-named of which drew up the proposals for union between the Greek and Latin churches. Among his works may be mentioned 'Meditations' (1467), 'Questiones Spinolesis' (1470), 'De verauris et Evangelis' (1477); and 'Commentarii in Decretum Gratiani' (1519). Consult Lederer, 'Der spanische Cardinal Johannes von Torquemada' (1879).

TORQUEMADA, Tomás de, Spanish monk, first Grand Inquisitor of Spain: b. Valladolid, 1420; d. Avila, 16 Sept. 1498. He entered the Dominican order, was for 22 years prior of the monastery at Segovia, and in October 1483 was made by Sixtus IV inquisitor-general for Castile and Leon. The Inquisition (q.v.) had been established in 1480 at Seville, but Torquemada was the first to give it its organization. He founded four tribunals at Seville, Cordova, Jaen and Villa Real. During his 18 years of office he burned 10,220 persons and condemned 6,800 to be burned in effigy. By these methods the Inquisition acquired vast sums of money. Torquemada was justly hated, and never went about without a body guard. His later activities were directed against the Jews and about 1,000,000 of them fled the country to escape his persecution. He was one of the most bloodthirsty fanatics of history. Consult standard works on the history of Spain and of the Inquisition; also Molines, 'Document Inédits. Torquemada et l'Inquisition' (1897).

TORRE DEL GRECO, tór-re dël gra’ko, Italy, on the Bay of Naples, seven miles south-east of Naples at the foot of Vesuvius. The town has been demolished by earthquake at various epochs, and in 1857 and 1906 a similar disaster greatly changed and damaged the locality. It is much frequented by foreigners and the luxurious Italians on account of its sea-bathing. There are important coral and other fisheries, besides shipyards, manufactories of rope, coral goods and lava ware. Pop. of commune about 3,000.

TORRENCE, Frederic Ridgely, American poet: b. Xenia, Ohio, 27 Nov. 1875. He was educated at the Union University, was librarian in the Astor Library 1897-1901, and since 1901 at the Lenox Library, New York. He has published 'The House of Hundred Lights' (1900); 'El Do'Tragedy' (1903); 'Aubard and Helen' and other dramas, 1909.

TORRENES, William Erskine, a promoter: b. New York, 15 July 1870; d. 1914. After making a study in New England and Philadelphia of mining methods and finance, he became foreign commissioner for the Canadian Imperial Bank of Commerce in 1899, and was subsequently engaged until 1909. During his time he secured concessions from Brazil, Argentina, Cape Colony, China and Japan for establishing sample works and the exhibition of American manufactures. He has written 'Commercial Travels in South America' (1897); 'Commercial Travelling in South Africa' (1898); 'Commercial Travelling in the East' (1899).

TORRENS, Lake, South Australia, a shallow salt lake, the central one of a chain in the central southern section, 125 mi. and 25 miles wide, about 80 miles from Spencer's Gulf. In the dry season duced to a salt marsh.

TORRENS SYSTEM, a system of registration devised by Sir Robert Town and first successfully used in Australia. The object is to make the transfer of landed property simple and as safe as that of any other property and to do away with the necessity of repeated title examinations. The system operates through a bureau of registered charge of a registrar, and becomes the first transfer of any property at establishment of the system, all land being registered in this office. A title registered as absolute or as possessory, or registry the title is fully investiga the registrar, who receives from the owner the documentary evidences of title, deeds, of boundaries, etc. When the registrar is satisfied that the title is perfect, he files the old papers and issues the certificate of ownership, a duplicate of which is filed in the registrar's office. Such certificate bears on its face notice of any interest on the property. If the estate is vested in simple title is known as 'absolute' certificate is stated to be an absolute. Should it appear that an absolute to any land can be held only for a period or subject to reversion, then the of title, right or interest arises the specified date or under the named, all of which will be entered in register and noted on the certificate is stated to be a 'qualified' certificate the case of a 'possessory' title the name registered as becoming owner on evidence of title as may be prescribed. Registration of any person as first of a possessory title only will not interfere with the enforcement of any estate, or adverse to the title that may in which may arise a later date. And is noted on the 'possessory' certificate to the owner. The registration of title does not have to be repeated a certificate has once been issued, the
TORRENTS OF SPRING ('Veshchera Vo'dui'), by Ivan Sergeevitch Turgotin, is the tragic-comedy of a man of weak will who succumbs to a passionate impulse, yields to the seductions of the typical "vampire" woman and throws away the happiness of his whole life. "Weak men," says the author, "never bring things to an end; they always wait for the end to come." The title is symbolical and not quite adequate, the comparison being introduced in the wrong place.

Sànin, a young nobleman, is in his 22d year, very good-looking, with handsome graceful figure, kindly bluish eyes, golden hair, a clear skin, a smile like a child's and giving the impression of "freshness, health and softness, softness, softness," a man "recognizable at a glance as the son of a sedate aristocratic family, the type of the fine young pom'eschik, born and reared in our wide steppe-like regions." On his way home from Europe to Russia he is detained for a few hours at Frankfurt-am-Main, and by chance drops into a confectioner's shop conducted by the widow of a Lutheran minister. It happened that just at that moment Emilio the only son had faited and his sister, Gemma, a young girl of exquisite beauty appeals to Sànín to bring him back to life. This the young man does; the family are profuse in their expressions of gratitude and persuade him to remain for a few days in Frankfurt. During a Sunday excursion with the two young people and Gruber, a bumptious and conceited German clerk to whom Gemma is betrothed, an intoxicated officer, Baron von Dönhof, insults the young girl, and when her lover shows no spirit to resent it, Sànín impulsively takes it upon himself to provoke the inevitable duel. This duel is described at considerable length with a wealth of comic detail. Neither party is injured and the Russian and the Baron part almost friends.

It results, however, in Gemma's breaking her engagement with the ridiculous and pusillanimous Gruber, but Signora Roselli hogs Sànín to use his influence with her daughter to persuade her not to ruin her prospects and reputation by such an act, an engagement being regarded in Germany as no less sacred than marriage itself. Sànín reluctantly undertakes to fulfill this delicate mission but finds it impossible, since he has himself fallen in love with the beautiful girl and she is no less fascinated with him. He decides to sell his estate in Russia and invest money in the widow's confectionary business. By another turn of fate he meets at this moment his former schoolmate, Póllozof, another type of the lazy, easy-going Russian, who is married to an enormously rich young woman. Póllozof tells Sànín that his wife will perhaps buy his estate and offers him a place in his carriage to Wiesbaden where Mária Nikolayevna is taking a cure. She is beautiful but unscrupulous and plays all her arts to fascinate Sànín, who weakly yields and never returns to Gemma. Thirty years later Sànín, always unhappy in his remorse for his dastardly behavior, with a little garnet cross which Gemma had given him. It brings up all the details of his soul's tragedy. He goes to Frankfurt and through Baron von Dönhof learns that Gemma had married a rich American. He writes to her and when she replies,
enclosing a photograph of her own daughter, he sees in the picture the very image of his lost love and sends her the garnet cross together with a magnificent string of pearls. Gemma is the very ideal of sweet girlish purity and is presented in striking con-
trast with the fascinating and not unsmys-
pathetic Russian siren who ruins men for her
selfish amusement. It is an amusing and yet
rather repulsive story. Originally published in
the European Messenger (Pesoithi Velovokup)
in 1872, it has been translated as 'The Torrens of
Spring' by Constance Garnett (1897); 'Spring Freshets' by Isabel F. Hapgood (New
York 1904); 'Spring Floods' by S. M. Butts
(1874-75), and by E. Richter (London 1896).
NATHAN HASKELL DOLE.
TORGES NAHARRO. B. de., Spanish
dramatic poet: b. near Badajoz, about 1500.
He is called the creator of Spanish comedy
and was the first writer of his time to develop
fully his plots. He wrote fluently in both
poetry and prose and his collected works
were dedicated to Ferdinand d'Avalos, the husband
of Vittoria Colonna. It was not until 1520,
however, that his plays became known in Spain
where they were very popular.
TORGES (tôr'res) STRAIT, the narrow
channel which separates Australia and Papuan From Cape York on the northern coast
of Australia to New Guinea it measures about 80
miles. Navigation is unsafe owing to the
shoals, islands and reefs within its waters. It
was discovered in 1606 by a Spanish navigator
from Peru.
TORGES VEDRAS, tôr'res vá'drás, Por-
tugal, a town in the district of Lisbon, situated
on the railroad, 25 miles north of Lisbon. It
is noted for its extensive lines of fortifications,
28 miles long, reaching to the Tagus River, and
protecting 500 square miles of territory. They
were begun in 1809, and behind them Welling-
ton in 1810 checked the French advance toward
Lisbon. It has hot sulphur baths and an old
Moorish citadel. Pop. about 8,000.
TORMEY, tör'l, Bradford, American nat-
1842; d. New York, 19 Feb. 1899. He was educated in the public schools, taught two years, entered business in Boston, and for many years after 1866 was a member of the editorial staff of the Youth's
Companion. He has been well ranked as a
field ornithologist, and wrote entertainingly of
his observations. His essays have been collected into the following volumes: 'Birds in
the Bush' (1885); 'The Foot-Path Way' (1892).
'A Florida Sketch-Book' (1894); 'Spring
Notes from Tennessee'; 'A World of Green
Hills' (1898); 'Every-Day Birds' (1900);
'Nature's Invitation' (1904); 'Friends on the
Shelf' (1906); 'Field Days in California'
(1913).
TORMEY, Charles Cutler, American Se-
1863. He was educated at Bowdoin College
where he taught Latin (1885-90). He studied
at Andover Theological Seminary (1886-89)
and at the University of Strassburg (1889-92)
where he took his Ph.D. degree. Since that
time he has been in touch with languages at
Andover (1892-1900), director of the Ameri-
can School of Oriental Research in Palastine
(1900-01), editor Journal of the American
Oriental Society (1900-07; 1911-16) and presi-
dent of the society (1917-18). His publica-
tions include 'The Commercial-Theological Tens
in the Koran' (1892); 'Composition and His-
torical Value of Ezra-Nehemiah' (1896); 'The
Mohammedan Conquest of Egypt and North
Africa' (trans. from the Arabic, 1901); 'Sele-
cions from Bokhari' (1906); 'Notes on the
Arabic past of Daniel' (1909); 'Ezra Studies'
(1910); 'Composition and Date of the Aras
(1916). Since 1900 he has been attached to
Yale College.
TORMEY, Charles Turner, American
anti-slavery reformer: b. Scituate, Mass., 21
Nov. 1813; d. Baltimore, Md., 9 May 1846. He
was graduated at Yale in 1830, entered the Congregational ministry, and held pastorates at
Princeton, N. J., and Salem, Mass. Having re-
moved to Maryland to promote the cause of
anti-slavery, he became an active agent of the
Underground Railroad (q.), and was arrested
and imprisoned on the charge of being a
slaveholders' convention held in Baltimore.
The following year he was again arrested and
being convicted of aiding in the escape of run-
away slaves, he was sentenced to a long term
in the penitentiary. The harsh treatment he
received while undergoing his sentence brought
on consumption from which he died, and his
remains were taken to Boston where he was
honored by a public funeral. He was regarded
as a martyr in the cause of freedom, and Torme-
ry's blood cried out' became an anti-slavery
watchword. He wrote 'A Memoir of William
R. Saxton' (1838), and while in prison pro-
duced a volume of sketches of Massachusetts
life, 'Stone, or the Pilgrim's Faith Revived'
(1846). Consult Lovejoy, 'Memoir of the
Martyr Torrey' (1847).
TORMEY, John, American botanist: b.
New York, 15 Aug. 1796; d. there, 10 March
1873. He received his first instruction in botany
mineralogy and chemistry from Amos Eaton
and was graduated at the New York College of
Physicians and Surgeons in 1818. His skill from medical practice he devoted to
pursuits, particularly to botany, and in
abandoned medicine and became professor of
chemistry, mineralogy, and geology at West
Point. From 1827 to 1855 he was professor of
chemistry and botany at the College of Physi-
cians and Surgeons, serving simultaneously at
Princeton. From 1853 until his death he was
chief assayer in the United States Assay Office;
New York. He participated in the Columbian Exposition as trustee, and in 1860 pre-
sented to that institution his extensive her-
barium and botanical library. In his special
field of scientific research his publications were
numerous. One of his earliest was a 'Catalogue of Plants Growing Spontaneously
Thirty Miles of the City of New York' which
he prepared for the New York Library of Natural History (now the New York
Women's Institute of Science), of which he was a
and for many years president. In the
botanical of the Geological Survey of New
York he published an elaborate work on the flora
of the State. Meantime he had issued in com-
mission with Asa Gray (q.), the first of a
series of articles on 'The Flora of North America' which was discontinued after the completion of

order Compositae. From 1845 onward he published memoirs and reports on the botanical specimens brought back by expeditions to various parts of the West and South by Capt. John C. Fremont and others, among them being reports on the botany of the Pacific railroad and making the Mexican boundary survey. He was president of the American Association for the Advancement of Sciences in 1860 and was in the American Academy of Arts and Sciences in 1863 one of the original members of the National Academy of Sciences.

Torrrey, Joseph, American clergyman: b. Rowley, Mass., 2 Feb. 1797; d. Burlington, Vt., 26 Nov. 1867. He was graduated at Dartmouth in 1816, and at Andover Theological Seminary in 1819. He was for a time pastor of a Congregational church at Royalton, Vt., but in 1827 became professor of Greek and Latin at the University of Vermont. In 1842 he took the chair of philosophy there, and in 1863 he was president of the institution. He translated Neander's 'General History of the Christian Religion and Church' (1854), and edited 'Remains of President James Marsh' (1843) and Select Sermons of President V eh P. Smith' (1861). A volume of his lectures, 'A Theory of Fine Art,' appeared posthumously (1874).

Torrrey, Reuben Archer, American evangelist: b. Hoboken, N. J., 28 Jan. 1856. He was educated at Yale College and at Leipzig and Erlangen in Germany. He was ordained as a Congregational minister in 1878, was superintendent of a large church in New York City, and became associated with Dwight L. Moody in 1889 and served as superintendent of the Moody Bible Institute until 1908. In 1902-03 he made an evangelistic tour of the world. His life has been devoted to evangelistic work in many lands and he has written much on Bible subjects which have been translated in a score of languages.

Torrrey Botanical Club, a botanical society in New York, which is the most important organization of its kind in America, and one of the most scientific societies affiliated in the Scientific Alliance. The club was an outgrowth of a former club, chartered in 1871. This had met in the herbarium of Columbia College, drawn there by the genial welcome and wide botanical knowledge of its presiding spirit, Dr. [John] Torrey, and was the nucleus of the present club, finally organized under its present name, complimentary to Dr. Torrey, in 1873. Dr. Torrey was the first president, but, unfortunately, died almost immediately.

The Torrey Club is the centre of botanical interest in New York, and the neighborhood, and is especially valuable for its weekly excursions that may be joined by any botanist, and which take parties out to good botanizing localities under intelligent guidance. Many local floras have been compiled by members of the club, one of the most important of which is of the plant life of the Rocky Mountains. 'The Preliminary Catalogue of Anthophyta and Pteridophyta growing within 100 miles of New York.' The valuable herbarium of the club includes the material for this list, and specimens of the flora, within the same area. It is now deposited at the New York Botanical Garden, which was originated and developed by members of this society. The club issues three regular publications, namely: Bulletin, a very scientific and widely known journal; Torreyo, of more popular scope; and Memoirs, which include many valuable monographs for ascertaining the most practicable route for a Pacific railroad and making the Mexican boundary survey. He was president of the American Association for the Advancement of Sciences in 1860 and was in the American Academy of Arts and Sciences in 1863 one of the original members of the National Academy of Sciences.

Torrivecelli, Torr-ree-chell, Evangelista, Italian mathematician and scientist: b. Faenza, Italy, 1608; d. Florence, October 1647. He early devoted himself to mathematical studies, and having read Galileo's 'Dialogues,' composed a tractate concerning motion, entitled 'Le principia.' Galileo having seen this, conceived a high opinion of the author, and engaged him as his amanuensis. He accordingly went to Florence in October 1641, but Galileo dying three months after, Torrivali returned to Rome, where he was engaged in the discovery of the natural law according to which fluids rise in an exhaustted tube from an open vessel exposed to the pressure of the atmosphere, namely, that the weight of the fluid which rises in the tube is equal to the weight of an equal surface of atmospheric air of the height of the atmosphere. He also improved the telescope and microscope. See BAROMETER.

Torrivecellian Experiment, The, so-called because made by the Italian physicist Evangelista Torrivali (q.v.), who discovered the principle upon which barometers are made. Torrivel was led to investigate Galileo's theorems of the law that "nature abhors a vacuum." He filled a glass tube, closed at one end, with mercury, and placing his finger over the open end inverted the tube. He now placed the tube vertically in a small trough containing mercury and removed his thumb from the open end, after it was under the surface of the mercury. The mercury in the tube dropped until it stood at a height of about 30 inches. Here it rested, with a vacuum in the top of the tube, under the closed end. Torrivel concluded that the column of mercury in the tube was sustained by the pressure of the atmosphere on the larger surface of the mercury in the trough and that the height of the column was in inverse ratio to its specific gravity. Other experiments confirmed this theory and led to the invention of the barometer (q.v.).

Torrigiano, Pietro, Pë-trë tór-rë-jea'n°, Italian sculptor: b. about 1470; d. Spain, 1522. He went to England in 1509 to erect the tomb of Henry VII and his queen, still in Westminster Abbey. The works which he executed for English churches were destroyed by the Puritans. He was given a commission to make a statue of the Virgin Mary, and receiving what he considered an inadequate price destroyed it. For this he was imprisoned by the Inquisition, and there starved to death.

Torrington, Frederick Herbert, Canadian musician: b. Dudley, England, 20 Oct. 1837, and was educated there. When but 16 years of age he was made organist (1853) at Saint Anne's Church at Bewdley, England, and in 1857-69 he held a similar position at Great Saint James Street Methodist Church, Montreal, Canada. He then went to Boston where
he was organist in Kings Chapel (1869-73) and professor in the New England Conservatory of Music. Returning to Canada he became organist of the Metropolitan Church at Toronto and conducted the Philharmonic Society there and founded (1881) the first Toronto musical festival. Two years later (1883) he founded the first college of music. He was elected president of the Canadian Society of Music in 1892. In 1895 and 1896 he conducted musical festivals at Toronto and in 1903 was assistant conductor of the cycle of musical festivals in that city.

Torrington, Tör'ing-ton, Conn., borough in Litchfield County, on the Naugatuck River, and on the New York, New Haven and Hartford railroads, about 23 miles west of Hartford and 18 miles north of Waterbury. Settlements were made in the vicinity in the early part of the 18th century, and in 1740 Torrington was incorporated. In 1887 it was chartered as a borough. It is the birthplace of John Brown (q.v.). The borough has a number of manufacturing establishments; chief among which are bicycle and machine shops, plate-works, brass-works, wooden mills and novelties. It also manufactures needles, hardware and tobacco products. In 1914 there were 54 manufacturing establishments, with a capital of over $16,000,000, and annual products of over $14,000,000, with payrolls of about $2,000,000. The principal public buildings are the churches, schools and the Young Men's Christian Association building. The educational institutions are a high school, public and parish schools, several private schools and a public library. There are two banks. The borough is the commercial and industrial centre of the town of Torrington, which contains 20,000 inhabitants.

**Torsion Balance**, an instrument in which small forces are measured by noting the torsion that they can produce in a fine wire or a delicate fibre of some other material. The invention of the instrument is usually ascribed to Cavendish and Bunsen, but its employment having been suggested by C. V. Boys, it was his extensive researches on electricity, Cavendish also made use of it for the purpose of determining the mass of the earth; his experiment consisting in determining the attractive power of a pair of leaden spheres, and comparing this with the attractive power of the earth itself. In its conventional form, the torsion balance consists of a light horizontal arm, suspended at the centre by the fibre whose torsion is to measure the force that is applied to the arm. Quartz is now extensively used for the suspending fibre; its employment having been suggested by C. V. Boys, who showed how to prepare fibres of this material, which are very strong and elastic. Boys divided an arrow into matched halves and then fastened the arrow from a length midway the centre to a single fibre of quartz. The upper end of the fibre was attached to a graduated hook whereupon the fibre can be twisted through one entire turn; and a simple motion then gives the repulsive force designed application of the torsion balance to the measurement of mental work of other kinds will be understood from the foregoing description of application to the measurement of electrical pulsions; for the principles involved are the same in all cases, the force that is produced being determined by noting the torsional moment of the fibre, which is proportional to the angular displacement of the fibre. In actual service the balance is surrounded by a case of glass, the air in which is kept dry by a close-fitting calcium chloride, or phosphorus crucible, or paraffinum stone wetted with a sulphuric acid or some other powerful volatile drying agent.

The torsion balance has also been used in a form of commercial instrument in which the weight is supported from a central ribbon of string in such a manner that when the
TORSIONAL RIGIDITY — TORTICOLLIS

at either end, the steel ribbons are d to a torsional moment which tends to the balance to the normal position of the.

Allan D. Risteen.

TORSIONAL RIGIDITY, that species of y by which a cylindrical bar of any ma-resists the action of a force (or "couple") tends to twist the bar in such a manner inerit its originally straight, longitudinal axis (or fibres) into a helical form. The rigidities of a pair of cylindrical bars tical dimensions but composed of difer-bstances may be compared by comparing vising moments that are necessary in to twist both of them through the same angle. If one end of such a cylindrical held fixed, while the other end is twisted ever applied to it after the manner of a t, the angle x, through which the bar will

\[ \theta = \frac{M}{g R} \]

\( g \) the length of the bar that is twisted, ug its diameter, and C being a constant r. of material of which the bar is made; while P and R are respectively the g force, and the length of the lever to d of which this force is applied. The um diameter that a shaft should have, in to transmit a given horse power safely, e calculated by the following formula:

\[ \sqrt{\frac{V}{H/R}} \]

where D is the diameter of the n inches, H is the number of horse power transmitted, R is the number of revolu- the shaft per minute, and F is a numeri-ter peculiar to each kind of material. For ht iron, F may be taken as about 4, and sel it may be taken as 3.8. Consult Kent, anical Engineer's Pocket Book; Ran- Applied Mechanics.

ORSK, a Scandinavian species of cod. See

ORSO, an art term applied to the trunk statue of which the head and limbs are g, or to the trunk of a statue considered endently of the head and extremities; also termed one of the shoulders by the Greeks of ancient sculpture recovered in the r centuries have been incomplete in this. The most famous is the Torsos Belve-s a torso of a statue of Hercules, seated. ives its name from the Belvedere, at in the Vatican Palace where it is pre, and is attributed to the school of us, being believed by some authorities to work of that master, although a Greek ascribes it to the artist Apollonius. considered by connoisseurs one of the works of art remaining from antiquity.

Rstensson, tor'ste'n-sen, Lennart, sh general: b. Torstena, 17 Aug. 1603; d. Holm, 7 April 1651. At 14 he became a c the court of Gustavus Adolphus and 3 accompanied him to Germany as cap- the bodyguard. He was commander of y at the battle of Lech, 5 April 1632, ken prisoner before Nuremberg in August in Ingolstadt. In 1641 he was ap-1 commander-in-chief of the Swedish in Germany. He defeated the Archduke Leopold and Piccolomini at Breitenfeld, 2 Nov. 1642, threatened Prague and relieved Olmütz in 1643, and after the declaration of war by Den-mark in December he advanced into that country and in six weeks had conquered the whole peninsula with the exception of the fortresses Rendsburg and Glückstadt. He defeated the Austrian general, Gallus, at Jüterbok, 4 Nov. 1644, and Katzfeld at Jankau, 6 March 1645, pushed through Moravia to the Danube and de-stroyed the fortifications on Wolfssbrücke be-fore Vienna. His siege of Brünn was unsuc-cessful owing to the stubborn defense and a pestilence among his troops, and after with-drawing into Bohemia, in 1646, he was com-pelled by illness to resign his command. He was made Count of Orta and governor-gen-eral of West Gothland by Queen Christina in 1647.

TORT is a legal term indicating an injury or wrong; tort may be committed with force, as trespass which may be an injury to the person, such as assault or false imprisonment or to property in possession, or a tort may be com-mitted without force, such as an injury to one's character or affecting one's personal liberty. One may be liable in damages for a tort, but same is distinguished from a similar right growing out of a contractual relation. An ac-tion in tort is a civil action which undertakes to discover if a wrong or crime is involved. A misappropriation of funds by a trustee, for ex-ample, must be inquired into before it can be certainly known: (1) that the fund is short; (2) that the defendant is responsible for the shortage; (3) whether there is a question as to the amount of the misappropriation; (4) whether the defendant simply owes such short-age, or (5) whether he stole it, and should be arrested. Actions in tort are common in cases of breach of contract, libel, trespass, conversion, assault, negligence resulting in accident, etc. Consult Burdick, F. M., 'The Law of Torts' (1905) ; Bohlen, F. H., 'Cases in the Law of Torts' (1912).

TORTICOLLIS, twisted neck, an affection in which, while the head is bent usually toward one of the shoulders, the head itself turns the chin to the opposite side. In this condition, known in various forms as stiff-neck or wryneck, lateral movement of the head often causes great pain, especially when the affection is due to rheumatism (q.v.). This attacks the muscles lying on the side of the neck, especially the sternomastoid. In the great majority of cases only one side of the neck is affected, the head being drawn more or less obliquely toward that side; but occasionally, in a form more strictly to be regarded as stiff-neck, both sides are equally attacked, in which case the head is kept stiffly erect and looking straight forward. As long as the head is allowed to remain at rest there is merely a feeling of discomfort; but every movement is apt to be extremely painful. This affection is usually caused either by exposure of the part affected to a current of cold air, or by wearing wet or damp clothes round the neck, but may also arise from spasm or strain of the muscles of the neck, causing a crick. It is usually temporary, but in some cases muscular contraction renders it perma-nent.
TORTOISE. See Box-turtle; Land-tortoise; Terrapin; Turtles.

TORTOISE PLANT, a loft climber (Testudinaria elephantipes) of southern Africa, resembling a yam, and belonging to the same family. It has slender twining stems, alternate, netted-veined leaves, small diocious bell-shaped yellowish flowers in axillary racemes, and triple-winged capsules. It is, however, characterized by its globular rootstock, sometimes four feet in diameter, and growing above the ground. This enormous tuberous structure is woody or succulent, and is covered with a soft curly bark, which, cracking by exposure, becomes tessellated with angular protuberant plates suggestive of those of the tortoise. When young it has also suggested the name of elephant's foot, and its utilization as a food by the natives has given rise to the title Hottentots-bread.

TORTOISE-SHELL, the material of the large epidermal scales of the hawksbill sea-turtle (Chelone imbricata). Thirteen of these plates cover the carapace, and of being joined together by their edges so as to make a vault. The portion of the shell posterior to the shield, and overlap each other like the tiles of a roof. They vary in size according to the part of the shell they occupy. The larger are sometimes from a foot to 18 inches long by six inches broad; the thickness rarely exceeds the eighth of an inch. The beautiful mottled color and semi-transparent characters of this material are well known. A remarkable quality is possessed by tortoise-shell which very greatly increases its usefulness for the ornamental purposes to which it is generally applied, that is, the property of being easily softened by a heat equal to boiling water, and of retaining any form when cold which has been given to it when heated. Pieces can also be welded together by the pressure of hot irons properly applied. The chief use of tortoise-shell is in making combs for the hair; but it is also used for infusing ornamental furniture and various other fancy objects. By the French chemists (roule de tortoise) it is used most effectively in combination with brass as a veneer for rich furniture, and all boule or "buhl" work consists of such a veneering combination. In India, China, and Japan many articles are made of it, showing great skill and taste.

TORTOISE-SHELL BUTTERFLY, a butterfly of the genus Tanaisa as the Camberwell beauty (q.v.), in reference to the reddish-brown, black and white coloration.

TORTOLA, tor-tö'-la, one of the Virgin Islands, West Indies, lying northeast of the island of Saint John, from which it is separated by a narrow channel; area, 24 square miles. It is hilly and rugged, the highest elevation being 1,000 feet. Only a small part of the land is cultivated, cotton and sugar are raised, and sugarcane and rum are exported. The island is, as of the most importance of the Virgin group and contains the chief town, Roadtown.

TOROJA, tor-o'ja, Spain, a city in Castile-La Mancha, southwest of Tarazona and 100 miles south of Valencia, on the Ebro River. Pop. 1,500. E. Barcar and L.A. Almansa. Much of the river. It occupies an activity rising from the left bank, forked, part of the walls being of great antiquity. There are several small squares, the streets are narrow and crooked, them very steep. The houses are built of red masonry, there is a cathedral and other and a monastery. There are the soap, paper, hats, leather, porcelain, facades, important fisheries. In the vicinity are remains of Roman ruins, also marble and a baster quarries. Pop. about 26,000.

TORTICIDE, a family of moths. ! LEAF-KILLER; MOTH.

TORTUGAS, tor-too'gas. See Dry TUGAS.

TORTURE, as a means of judicial punishment, descended to the countries of Europe from the Greeks and Romans, and was judicially inflicted either to extort a confession, purged sin, or aggravate punishment. As practised by the Greeks, it was not applied to a freedman, except in certain cases, but was commonly applied to slaves. Indeed the word torments applied to the sufferings of a slave, except under torture, and either party to controversy could demand the torture of his opponent's slaves. The principal modes of torture with the Greeks were the wheel, the sharp comb, the burning tines, the vi (into which the victim was bent double), the injection of vinegar into the nostrils. Fr. the Greeks the Romans got their system of torture and from the Roman laws it was engrained in the judicial systems of all the modern countries of Europe. The Romans, like the Greek exempted freedmen from the horrors of torture, except in cases of treason. But under emperors the torture of a freedman was not infrequent occurrence. The Romans too employed the rack, the scourge, hooks for tearing the flesh, and fire in its various uses. Contact with barbarian races gave the practice to the latter, but with one exception it was slow headway in replacing the older and superstition (q.v.). The exception is in the case of the Visigoths who established a system of torture that remained uninterrupted from the time of their se in Spain to modern times, and which is a model upon which most of the other nations were based. Localized terror came common in France during the wars of the 13th century and in Germany a century later. English lawyers assert that it was localized in Great Britain, but certain that it was commonly practised, and, if directly enjoined, was at least sanctioned by laws of that realm. All Europe came to the system during the 15th century, in the quence of the systematization of the law (q.v.), and the growth that instance (q.v.), power and importance, and with the ex of Great Britain and Sweden, torture fo recognized department of the jurisprudence. The European nations until the end of the century. During the time the law of torture was applied by the civil, not by the ecclesiastical, court, and the ecclesiastics of the question were there simply as witnesses of the confession and not as agents, as the history has pictured them. A confess
toried by torture was of no avail to the prosecu-
tion before an ecclesiastical tribunal, unless it was voluntarily confirmed three days afterward. From the 13th century on, the use of torture increased, until its extreme cruelty and the horror of its practice led to a revulsion of feeling and to its general abandonment in the latter part of the 19th century. However, it continued, to be officially recognized and sporadically employed until the early part of the 19th century. It was abolished in Saxony in 1783, in Russia in 1801, in Württem-
berg and Bavaria 1809-17, in France in 1795 (although it was employed in 1814), in Han-
over in 1819, and in Baden in 1831. It is believed, however, that it was practised in Russia even early in the 20th century. It never was sanctioned in the United States, though "witches" were burnt near Salem, and the burn-
ing of negroes for rape by lynch law still persists. Consult Lea, H. C., 'Superstition and Force' (1870); Pearsall, R. L., 'The Kiss of the Virgin,' etc., (1898); Sassen, M. J., 'Dis-
putatio de abusu usu torturae' (1697); Parsons, 'Studies in Church History' (Vol. II, Art. "Inquisition," 1895). See INQUISITION; RACK.

TORU DUTT, tōˈru doot. See Dutt, Toru.

TORY, Henry Marshall, Canadian min-
ister and educator: b. Guysboro, Nova Scotia, 1867. He was educated at the local academy and at McGill University where he was gradu-
ated in 1890 with high honors in mathematics and physics. He studied theology at Wesleyan University and entered the Methodist Church in 1890 but retired in 1892 to become lecturer in mathematics at McGill University and was pro-
fessor there until 1908 when he was chosen president of the Provincial University of Alberta at Strathcona. He published 'A Manual of Laboratory Physics' (1902).

TORY, the name of a political party, used in Great Britain and other Anglo-Saxon coun-
tries, is said to have originally been applied to the Roman Catholic outlaws who lived in the bogs of Ireland during the reign of Charles II. The name became identified with the opponents of the Duke of York from the English succession (1679), and was thus in-
tended to imply Roman Catholic sympathies on the part of the duke's adherents. It was trans-
ferrred to the court party in English politics, their opponents being classed as Whigs. Since the clergy of the Church of England had the doctrines of passive obedience and the divine right of kings, they also were known under the name of Tories. In modern English politics the successors of the Tory party are known as Con-
servatives, but the old term is not infrequently heard in Parliamentary debate. Political parties in British colonies at times followed closely the divisions and names in England, so that in Australia and New Zealand the conservative elements in the representative assemblies were known as Tories. In the American colonies the name was given to the adherents to the policy of the mother country, and during the Revolu-
tionary War was applied to all persons sus-

TOSCANELLI DAL POZO, Paolo, tōsˈka-nəlˈle dàl pöˈso, Italian geographer: b. Florence, Italy, 1397; d. there, 1482. He be-
lieved that India could be reached by sailing to the westward and so advised Columbus 1474. He also gave the king of Portugal similar views. It is thought that he strengthened the views of the great navigator to undertake the western voyage, although not alone in doing this. Consult in some country, 'Toscanelli and Columbus' (New York 1902).

TOSTI, Sir Francesco Paolo, frānˈchēzˈkō pāˈlo tosˈte, Italian composer: b. Ortona di Mare, 7 April 1847; d. 1916. He was a pupil and later teacher at the Conservatorio Reale, Naples, and in 1869 appeared as a concert singer at Rome. Shortly afterward he became vocal instructor at the court; removed to London in 1875 and in 1880 was appointed in-
structor to the royal family. He produced 'The Grand Duke' (opera, 1888); 'La prima donna' (opera, 1889) and many English and Italian songs. His 'Good-bye'; 'For Ever and For Ever'; 'That Day,' etc., are widely popu-
lar. He was knighted in 1908.

TOSTIG (TOSTI, TOSTINUS), West-
Saxon warrior: d. 1066. In 1055 he was made earl of Northumbria, Northumberland and Huntingdonshire, by Edward the Confessor. A stern ruler, he repressed feud and disorder by the exercise of a merciless justice (patriam pur-
gando italiam cruciata vel necte), with no dis-
inction of rank. In 1063 he joined his brother Harold in the invasion of Wales, but in 1064, for treacherous murder, was outlawed, while Morcar was chosen to the earldom (1065). He retired into exile in Flanders, in 1066 committed various depredations on the Isle of Wight, Lindsey and the east coast and subsequently joined Harold Hardrada, king of Norway, in an invasion of England. They landed in York-
shire, but were entirely overthrown by Harold and his household troops at Stamford Bridge. Tostig figures in Tennyson's drama of 'Harold' (1877). Consult Green, 'The Conquest of Eng-
land' (1884); Freeman, 'History of the Nor-
man Conquest' (Oxford 1887).

TOTARA, or TOTARRA, a tree (Podo-
carpus totara) of New Zealand, of the yew
family, excelled only by the kauri for general utility, and most abundant in the forest of North Island. It is from 60 to 80 feet in height and has a fibrous brown bark which is deeply furrowed and was used by the natives for roofing their huts. Its leaves are linear and of a greenish-brown color. The wood is red-
dish-brown, clear and straight in the grain and does not warp or twist. It is largely used for furniture, cabinet-work and house-building, but is particularly valuable for bridges, wharves and marine pilings, as it is durable under ground or water and resists the attacks of teredos for a long time. The aborigines made canoes from the trunks of these trees. See PODOCARPS.

TOTEM, a word which appears to have been applied originally to the animal or other thing held sacred by certain tribes as the sign or symbol of the tribe or of an in-
dividual Indian. The superstition is not con-
fined to American Indians and has its counter-
part in the symbols of civilized nations. The American eagle, the lion of Britain, the thistle of Scotland, the rose of England, etc., and the arms of noble families are illustrations.
The practice can be traced, indeed, throughout all history, among the greatest empires and the most savage tribes.

The totem superstition varies in its features in different countries. The members of the Emu clan of an Australian tribe believe themselves descended from the Emu and are regarded as forming a kind of blood-group in virtue of their common descent. No member is permitted to marry within the clan, and all the members are bound to support one another in any unforeseen misfortune. No Emu clan member will knowingly kill or eat an Emu. Among some savage peoples the dead totem is elaborately mourned and carefully buried. Besides clan totems there are sex totems and individual totems. The totem having an important bearing on a person's relations to his fellows, it is shown conspicuously, being often tattooed on the skin or otherwise. The importance of totemism in relation to the social and religious institutions of savage peoples was first pointed out by Sir Edward Youde, though it had been observed by subsequent investigators but no satisfactory explanation of this curious system has yet been advanced. The American Indians were given to totemism and not only set up various clan totem figures as emblematic of their tribes but individuals were frequently named after animals. The exact meaning and character of their totem practices is little understood. There were rules as to all marriages of those in kindred totems; some took their totems from their fathers, some from their mothers and some from their tribe. Totemism exists also among many African peoples, and numerous instances of it are to be met with in Asia and Polynesia. (See Africa; Australia; Indians; Americans). Consult Lang, A., 'The Secret of the Totem' (1905); Frazer, 'Totemism' (1887); Durkheim, E., 'Elementary Forms of the Religious Life' (Eng. trans., London 1915).

**TOTEM POLE.** A pole used among North American Indians to exhibit the totem figures. The totem pole is composed principally of three half human, half animal figures, seated above one another and holding erect a pole on the summit of which, for instance, is the totem. See Totem.

**TOTENICAPAM, tō-tō-nē-kā-pām.** Guatemala, the capital of the department of the same name, situated 60 miles northwest of the city of Guatemala. It manufactures cloth, pottery and wooden implements. It was half destroyed by an earthquake in 1902. The population, consisting almost entirely of Quech Indian, is about 28,000.

**TOTEL, Richard.** English printer and publisher; b. about 1525; d. 1594. He was granted a patent in 1553 to print law books, which was extended for life in 1559. He also published the works of the men of his day. He has no various animal figures as emblematic of the various totemic clans. Among his other publications were the translation of 'De Officiis' by Grimaldi (1556) and the translation of the second and fourth books of the 'Aeneid' by Surrey (1557).

**TOTEL'S MISCELLANY.** The work which commonly goes by this name was published under the title 'Sones & Sonete written by the ryght honorable Lorde Henry Haward [i.e., Howard] late Earle of Surrey, and other,' by the stationer Richard Tottel. On 3 June 1557 the population of the second edition was issued in the following month and six others followed within the century. Tottel's method, too, was imitated by other editors and publishers and doubtless stimulated the vogue of verse in popular called the Elizabethan anthologies. In the address of 'the Printer to the Reader,' he alludes to the verse of well-known Latin and Italian poets, adding: 'That our song is able in that kynde to do as praiseworthy as the rest, the honorable stile of the noble earle of Surrey, and the weigthinesse of the depe-witted sir Thomas Wyat the elders verse, with several grace in sondry good Englishe writers, doe show abundantly.' This passage indicates the purpose of the volume: namely, the effort which it represents to beautify English poetry and to show that the art of the Italians could be rivalled by the new courtly or cultivated school of British poets. Compare, for instance, the version of a work called 'The Arte of English Poesie' (1589), attributed to one George Puttenham: 'In the latter end of the same kings raigne [i.e., Henry VIII] sprung up a new company of courtly makers, of whom sir Thomas Wyat the elder and Henry Earle of Surrey were the two chieftains, who having traviled into Italie, and there tasted the sweete and stately measures and stile of the Italian Poesie, as novices newly crept out of the schools of Dante, Arioste and Petarch, they greatly polished our rude and homely maner of vulgar Poesie, from that it had bene before, and for that cause may justly be sayd the first reformers of our English metre and stile.'

Wyatt had died in 1542 and Surrey in 1547, but it was reserved for the publisher Tottel to secure manuscript copies of many of their poems and bring them out for the first time in print. These occupy the place of honor in the volume, being followed by the works of Richard Sibyls, Nicholas Grimaldi (who has been suspected of acting as Tottel's editor) and by those referred to 'Uncertain Authors.' A number of the poems in this last group can be identified, one of them, indeed, being a now familiar lyric of Chaucer's, but the majority remain anonymous, nor is any of these comparable to the best work of Wyatt and Surrey. The elements of familiarity and of novelty in the collection are perhaps best illustrated by the metrical form of the various poems. One finds, for example, the old 'rhyme royal' stanza of Chaucer, and the loose, sometimes doggerel 'septenary,' or seven-foot line, which had been popular from the Middle English period; but side by side with these occur the stanzas of the 'Statius' company which he left in 1589 because of poor health. His most notable work was done in compiling and publishing the first poetic anthology in England, 'Tottel's Miscellany' (1557), which contained 45 anonymous animal figures as emblematic of the various totemic clans. Among his other publications were the translation of 'De Officiis' by Grimaldi (1556) and the translation of the second and fourth books of the 'Aeneid' by Surrey (1557).
sulting type of sonnet, in three quatrains and a
couplet, which was to be the favorite in the
Elizabethan age and the form chosen by Shake-
speare. Outside the work of these two poets,
the sonnet was of slight intrinsic value; but its historical importance is so
marked that because of its publication in
1557 it is customary to date from that year
the beginnings of modern English poetry.

The convenient modern edition of Tottel's
Miscellany is that in Arber's 'English Reprints'.'
For accounts of the poetry of Wyatt and
Surrey consult Courthope's 'History of English
Poetry' and Padelford's 'Early 16th Century
Lyrics' (Belles Lettres Series).  

RAYMOND M. ALDEN.

TOTTEN, tö’tén, Charles Adiel Lewis,
American inventor and military instructor: b. New London, Conn., 3 Feb. 1851; d. Milford,
Conn., 12 April 1908. He was graduated at
West Point in 1873 and was instructor in mili-
tary science and tactics at the Amherst Agri-
cultural College, at the Cathedral School, Saint
Paul, Minn., and at Yale University. He
patented improvements in high explosives,
in collimating sights and in signal-shells; besides
a system of weights and measures and improve-
ments in linear and other scales. He patented
a war game which he described in a publication
entitled 'Strategos, the American War Game'
(1880) and has also published 'Important
Questions in Metrology' (1883). More recently
he issued 'Lost Israel Found in the Anglo-
Saxons' (1890) and 'Joshua's Long Day and
the Dial of Ahaz' (1891).

TOTTEN, Joseph Gilbert, American mili-
1785; d. Washington, D. C., 22 April 1864. He
was graduated from West Point in 1805, was
engaged in a survey of Ohio and the western
territories, and in 1806 resigned from the army.
He re-entered the army in 1808, was reappointed
second lieutenant of engineers and was in the
events of the War of 1812 at Fort William
and Fort Clinton in New York Harbor until
1812. He was chief engineer in the army on the
Niagara frontier during the War of 1812, was
brevetted lieutenant-colonel in 1814, and after
the death of Major-General Totten, was con-
sulted by Captain William H. Smith as to the
coast defenses until 1838 when he was pro-
moted lieutenant-colonel and chief engineer in
the army, and shortly afterward became su-
pervisor and inspector of the United States
Military Academy. At the outbreak of the
Mexican War he was placed in charge of the
engineering operations and in recognition of
his services in planning the siege of Vera Cruz was
brevetted brigadier-general in 1847. He then
resigned from the army, but was ap-
pointed one of the commissioners for arranging
the terms of capitulation. He became brigadier-
general in 1863 and in 1864 was brevetted
major-general. He published 'Essays on Hy-
draulics and Other Currents' (1842).

TOTTENHAM, tö’tën-nam, England, a town
of Middlesex, forming a residential suburb of
London and situated some six miles north of
the Tower of London, just outside of the city
limits. It was a favorite resort of Isaak Walton.
Among its most interesting buildings are the
old church, engaged by the construction of Eliza-
bethan mansion formerly owned by Robert Bruce.
Pop. 150,000.

TOTTENVILLE, formerly an incorpor-
ated village in Richmond County, N. Y.; since
1898 in New York City. See STATEN ISLAND.

TOTUAVA. See BLUEFISH.

TOUCAN, too-kân or too'kân, a family
(Ramphastidae) of coccycgymorphous birds
somewhat resembling the hornbills, distinguished by the great development of the bill,
which is curved superiorly and bears a promi-
nent keel, with cutting edges frequently toothed.
The outer walls of the bill are extremely thin,
its interior is hollowed out into air-cells, and it
is thus rendered comparatively light. The
long tongue is slender and barbed along the sides.
The toes are paired, two forward, two back-
ward and the tarsi scutellated, the wings rather
short and the tail long, with 10 quills. The
toucans are confined to tropical America, where
about five genera and 60 species occur. They
are birds of brilliant and striking plumage, and
the bill and naked skin about the eyes partake
of this brightness of hue. Most of the species
are gregarious, spending most of their time in
hopping actively about among the treetops and
seldom flying far. The times of their greatest
activity are the morning and evening, when the
woodlands are filled with their loud harsh cries.
While fruits are their chief food, insects and
the eggs and young of birds are also eaten. They
have a characteristic manner of throwing back
the head and bolting their food. When
sleeping the head and tail are turned toward
each other and rest on the back. All of the
species, so far as known, nest in holes in trees,
the birds sometimes excavating a suitable place
in a decayed stub. Only two white eggs are
deposited.

The following are some examples of the
species, many of which are familiar in the col-
lections of zoological gardens. The toco toucan
(Ramphastos toco) is black with a black and
orange bill, blue circumocular areas and white
throat and rump. It is nearly two feet long
and inhabits Argentina and is distinguished by
the rufous underparts and the white head.

TOUCAN. See ELIZABETHAN;

TOUCHEY, tow'sî, Isaac, American jurist:
b. Newtown, Conn., 5 Nov. 1796; d. Hartford,
Conn., 30 July 1869. He received a private clas-
sical education, was admitted to the bar in 1818,
and established a law practice at Hartford.
He was State's attorney for Hartford County in
1822-25, served in Congress in 1835-39 and was
again State's attorney in 1842-44. He was
governor of Connecticut in 1846-47, and in
1848-49 was United States Attorney-General.
In 1850 he was elected to the State senate
and in 1855 was elected to the U. S. Senate.
He was appointed Secretary of the Navy by
President Buchanan in 1857 and served until
1861. His conduct of naval affairs was severely criticized. He was accused of favoring the secession cause by scattering the best ships of the navy in distant seas. The charge was denied, and he continued to be regarded as a sympathizer with the South.

TOUCH, the sense of feeling. See SENSES.

TOUCHSTONE, LYDIAN STONE, or BASANITE, a velvet-black jasper, used on account of its hardness and the uniformity of its texture and color as a streak tablet for determining the relative amounts of baser metal and pure gold in alloys. The sample is rubbed on the stone and the color is then compared with a series of standards of known composition. The expert is able quite accurately to determine the fineness of the sample, the streak becoming redder as the proportion of copper increases, or yellower as the percentage of gold increases. This method of testing has been in vogue from the earliest times, the name Lydian Stone appearing as long ago as 450 B.C. Modern methods of assay have now largely superseded the use of this stone.

TOULON, too-lon, France, a fortified seaport, naval arsenal, in the department of the Var, on the Mediterranean, 42 miles southeast of Marseilles. The port is separated from the roadstead by bomb-proof mole and comprises two parts: one, including the merchant shipping; the other, the dockyard, slip, arsenal, foundry, etc. The fortifications are very complete. The cathedral was founded in 1096. This, the hôtel-de-ville and a capacious theatre are the chief of the old buildings; more recent are the Musée Bibliothèque, Marine School, literary and scientific societies, and the aquarium and botanical gardens. The Place de la Liberté contains a splendid monument to the heroes of the Revolution; Le Place d'Armes, the Boulevard Strasbourg and Jardin de la Ville are prominent promenades. It has modern fortifications of the first class and is headquarters for one of the five maritime arrondissements carrying stores for the Mediterranean fleet, with important shipbuilding interests. The bay or harbor is defended by torpedoes and gunboats. On the hills north of the city, in the heart of the hills, is the famous fortress of Montalembert. In the 17th century, Louis XIV gave Toulon its importance as a naval station, making the dockyards and arsenal the finest of France. Toulon became famous as a stronghold in the 16th century. Here the English were defeated by the fleets of France and Spain (1574); and in 1793 Napoleon forced the English and Spaniards to evacuate the position—his first memorable victory, while commanding the French Republicans. In time of peace about 600,000 tonnage is entered and cleared annually. The principal trade is in wines, fruits and oils. There are metal factories and lace works. Pop. about 107,000.

TOULMIN, Henry, American lawyer: b. Taunton, England, 1767; d. in Washington County, Ala., 11 Nov., 1823. He came to Norfolk, Va., in 1793 and in 1794–96 was president of Transylvania University. He was appointed circuit judge of the state of Kentucky and in the latter year was appointed judge of the United States District Court of Mississippi. He assisted in framing the constitution of the State of Alabama, in whose legislature he served. He was author of "A Description of Kentucky" (1792); "A Collection of the Acts of Kentucky" (1802); "Review of the Criminal Law of Kentucky" (1804); "Digest of the Laws of Alabama" (1823).

TOULOUSE, Clé-ooz, France, capital of the department of Haute-Garonne, 140 miles southeast of Bordeaux, on the Garonne. It is the centre of railway traffic and river and canal freight in southern France. A fine bridge connects the town with the village of Saint-Cyprien. It is a quaint old town, but very enterprising. The most remarkable buildings are the cathedral, church of Saint Sernin, Hôtel de Ville, museum and Palais de Justice. The museum contains an almost unparalleled collection of objects d'arts from the Gallo-Roman to the Renaissance period. There are several fine academies of art, science and literature (one claiming its origin to have been in games of the troubadours of 1323), namely, Société des Jeux Floraux; professional and technical schools, a large public library, a writer of rare volumes, an observatory and botanical gardens. Toulouse is one of the larger cities of France, designated as the seat of a State university, which includes faculties of law, medicine, science, letters, etc. It has a library of over 150,000 volumes and nearly 5,000 students. There is also a large Catholic institution with theological, literary and scientific instruction. The name of the city was Tolosa, dating back before the Christian era, and is in English, Toulouse, from which Toulouse is in Latin, Tolosa, from which Toulouse is in French. The Visigoths, under King Wallia, made it their capital in 419. It was taken by Clovis in 507, and was Charlemagne's capital in 630. For many hundred years it was the foremost city of southern Gaul. The Saracens took it in 718. The name developed into Toulouse about 780, when Charlemagne made his young son Louis king of Aquitaine, with his capital there. About 850, the first Count of Toulouse established himself, and these nobles governed the city and southern France for over 500 years. The tribunal of the Inquisition was established at Toulouse. It was the scene of Huguenot massacres in 1562 and again in 1572. The manufactures include textiles, leather, camel, steam-engines, tobacco, brandy, etc. In modern history, the most important event was its defeat by the English, while in ignorance of Napoleon's abdication. Pop. (1911) of commune 149,570, the town proper being about 23,000 less.

TOULOUSE, University of, celebrated French school of higher learning, founded by
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Gregory IX in 1230 as a protest against Ilghesan heresy. It was originally a gical school but became noted as a school w and sided with royalty against the h. At the time the laws of the church and the national system it now includes only faculties of law, medicine and pharmacy, science and philosophy. There also is the y of Protestant theology of Montaup and y two free faculties of theology and a phy. Its library is noted and contains erably over 150,000 volumes.

TOLOUSE GOOSE. See Geese.

UMEY, James William, American pro- of forestry: b. Lawrence, Mich., 17 1865. He was educated at the Michigan illar Colleg in 1889, and was special at Harvard in 1893. He was assistant department of botany in the Michigan illar Colleg (1890–91), professor of y in the University of Arizona (1891–98), national forester of the United States Forestry and became director of the Yale School in 1910. He is the author of 1 books on forestry and kindred subjects.

OUR, Maurice Quenti de la, m-rès p de la toor, French painter: b. Saint in, 5 Sept. 1704; d. there, 18 Feb. 1788. He his art studies in his native town and devoted himself to the execution ets portraits in Paris, in which city he i such reputation that the most famous of contemporaries gave sittings to him. He e was elected to the Académie. He re- l to his native town in 1784 and the Saint and Museum now contains 80 portrait s of his. His 'Pompodor' is in the e; and there are two other of his pic- in the Dresden Gallery. Consult Patoux, yve de M. Quintin de la Tour au Musée int Quintin' (1886).

OURACO, a large and beautiful A of the genus Corythis; with a short, small, high bill; both mandibles notched serrated; short, rounded wings, with ree first quill graduated; a long rounded st, short feet and an erectile crest. Prevailing color is green, with purple on ng and the tail, the peculiar red of which tished by a special pigment called turacin. Feed on fruits, perch on the highest es of trees. It is a member of the family ant-caters (q.v.). Consult Newton, orny of Birds (New York 1896).

OURAINE, too-ran, a former province fuchy of France, bounded by Maine, anis, Berry, Poitou and Anjou. Its l was Tours. It now forms the depart- of Indre-et-Loire. It was anciently d by the Gallic tribe of Turones.

OURCOING, too-kwan, France, a town department of the Nord, nine miles ast of Lille. Before the war it was a uilt and prosperous manufacturing town mostly cloth, flax, hemp and shoe. It also a one hotel-de-ville in Renaissance style. I improved rapidly in a commercial sense. The staple manufactures are textiles of all especially woolen goods, velvet carpets ugs, cotton goods, and cloth. It was also a center of the woolen industry. The chief imports were wool, flax, yarn and hemp, and the exports combed wool, yarn, tissues, rags and flax. It was captured by the Germans in 1914, and sadly wrecked during the Great War. The population in 1911 was 82,000.

TOURGEE, toor-zhà', Albion Winegar, American jurist and author: b. Williamsfield, Ashatabula County, Ohio, 2 May 1838; d. Borde- daux, France, 21 May 1905. He was graduated at the University of Rochester (N. Y.), enlisted May 1861 as a private in the New York volunteers, was wounded at the first battle of Bull Run, and having been discharged, studied law and was admitted to the bar at Painesville, Ohio. In 1862 he re-entered the military service as first lieutenant in the 165th Ohio, in 1864 resigned, and in 1865 began professional practice at Greensboro, N. C. He was a delegate to the Southern Loyalist convention at Philadelphia in 1866, and at the constitutional convention of North Carolina, where he drafted the article on education. From 1868 to 1874 he was judge of the Superior Court of the State. During his term of office the Ku Klux Klan was exposed and largely broken up, and his services to this end were very efficient. The sworn statements of several members received by him were later utilized in a series of fictional works dealing with Reconstruction times in the South, of which 'A Fool's Errand!' (1879) was the best known. Contemporary interest in these books was great, and their sales were very large for those days. Tourgee was made consul at Bordeaux in 1897, consul-general at Halifax in 1903, and from then until his death was again consul at Bor- daux. He was editor of The Continent (1882–84); 5 vols., an illustrated weekly published in New York (Vol. III in Philadelphia), and also wrote a few law books. Among his other works were 'Bricks without Straw' (1880); 'John Eax' (1882); 'An Appeal to Caesar' (1884); 'Button's Inn' (1887); 'With Gauge and Swallow' (1889); 'Murvale Eastman' (1890); 'Out of the Sunset Sea' (1892), and 'The Mortgage on the Hipoof House' (1896).

TOURJEE, Eben, American musical con- ductor: b. Warwick, R. I., 1 June 1834; d. Boston, Mass., 12 April 1891. He studied at the Academy at East Greenwich, Rhode Island, and opened a small music store in Fall River, Mass. Later he turned to music-teaching, both privately and in the public schools. After a period of study in Europe he opened a conservatory at Providence in 1864. This institution was moved to Boston in 1867 and became the New England Conservatory of Music which has grown to be the most important music institution of the kind in America. In 1872, when the College of Music of Boston University was founded, he became its dean. He was the organizer of several large choruses, notably that assembled for the Peace Jubilee in 1869, and another of nearly 20,000 singers for the World's Peace Jubilee in 1874.

TOURMALINE, a common and widely distributed mineral, so named from an East Indian name, and known to earlier writers as schor. It is a very complex aluminum boro-silicate, with several marked varieties depending on the presence and proportions of other metallic oxides. The precise constitution of tourmaline has been recently studied elaborately by eminent
mineralogical chemists both in Europe and America, without exact agreement, save in its general features, as derived from a complicated beryl, or other acid. As regards to the acids present, three types are clearly determined,—iron tourmalines, mostly black; magnesia tourmalines, usually brown; and alkali tourmalines, in which some lithia is present, of red, green and other rich colors. These last, when transparent, yield beautiful gems, of a hardness of seven to seven and five-tenths and specific gravity three to three and one-tenth. The black variety is quite common in schists, gneisises and granites; the green, Brazilian emerald; the deep blue, indicolite, or Brazil; the colorless, achatite. The crystals are rhombohedral, hemimorphic and of prismatic habit, either short and stout or long and slender, with three, six, nine or 12 sides, and with hemihedral, or more rarely, simple habit tendencies. The prisms are often so deeply striated vertically as to completely obliterate the faces. The physical properties of tourmaline are very interesting; it is rendered highly electric, both by heating and by friction and it has remarkable polarizing action on light; so that plates cut from transparent crystals, parallel to their length, are much used in experiments in optics, mounted in the so-called tourmaline pincers. With this is connected a very high dichroism, such that the color is frequently quite different according as light traverses a crystal lengthwise or across. Entirely distinct from this is another peculiar feature, namely, the intermixture of two or more colors in the same crystals, either transversely (concentrically) or lengthwise, sometimes gradually and sometimes sharply; so much so that elegant gems have lately been cut from some of the crystals from Southern California which are half red and half green, with perfectly sharp demarcation between the two brilliant tints. The most noted localities for bright-colored tourmalines are the Ural Mountains; the island of Elba; Brazil; Paris, Me.; Hadham Neck, Conn.; and above all, several mines recently opened in San Diego and Riverside counties, Cal. (See Gems). Superb black tourmalines occur at Pierrepoint, N. Y.; fine brown crystals at Gouverneur, N. Y., and Hamburg, N. J.

TOURNACHON, Felix, French author and aeronaut; b Paris, 1820; d. there, 1910. He was educated in Lyon, studied medicine but returned to Paris and founded the Revue Comique in 1839 and in 1854 published the Panthéon-Nadar, both which brought him renown. His experiments in aerial navigation led him to construct a huge balloon, Le Gant, with which he made various ascensions. At the siege of Paris, he was invaluable as a carrier of information and commanded the company of aeronauts. He was the author of a number of publications including 'Les ballons en 1870' (1871) and 'Le Manège d'Oléron' (1883).

TOURNAI, tour-nä, Belgium, a town in the province of Hainault, on the Scheldt, 50 miles southwest of Brussels near the French border, 15 miles east of Lille. It is the seat of a bishop, has pleasant suburbs, fine quays and streets. Its ancient Romanesque cathedral has five towers and contains pictures by Rubens. Other churches are St. James, St. Brice and Saint Jacob, besides the belfry with its wonderful chimes. Other prominent features are a picture-gallery, a library of 60,000 volumes, an episcopal seminary, five hospitals, an asylum, museum of natural history, civic hall and theatre and a bronze statue of Princess d'Espagney, marble bust of Dumortier and many medieval buildings. The industries embrace the manufacture of woolen goods, hosiery, valuable carpets, linen, ribbon, faience, soap and candles, much of which is handwork. Tournai was in the 5th century the seat of the Merovingian kings, then belonged to France, but later was incorporated in the Spanish Netherlands. It lies near the scene of many battles in 1503, 1567, 1709, 1745 during which years it belonged to France, and in 1914, when it was devastated by the German invasion. Pop. 37,349.

TOURNAMENT, a friendly contest at arms among warriors of noble birth during the Middle Ages. The use of the term was not fixed and it denotes the gathering of the nobles and knights, the contests and the fetes or carousals which followed. A tournament often lasted several days, a week or two, and during this time the lords and knights would gather at the town in which it was to be held, with their servants and esquires, and each would establish quarters which would be made gay with flags and pennants and would erect his arms or insignia. Meantime there would be prepared the lists, the place where the contests were to be held; this consisted of a rectangular space of large dimensions, fenced in by rows of a railing and surrounded by galleries erected for the ladies and spectators of honor. Certain qualifications of birth were necessary for admission to the contests and each lord or knight had for sponsor some lady whose champion he claimed to be and whose colors he wore. The knights were attended by their squires who furnished them with arms, raised them if disinmounted, etc. The weapons used in the contests were lances with the point covered with the sword with point and edge dulled and decorated with clubs of wood. The knights wore armor which was heavy or light according to the customs of the section in which the contests took place; the latter were held under very exact rules and under the constant supervision of judges and governors. In some of the tourneys it was not allowed the contestant to dismount; he was to run so many courses with the lance or strike so many blows with the sword or mace, and the successful knights received prizes delivered by some lady who had been selected the queen of beauty. On the second day there was often a tourney for the esquires and perhaps on the third day there would be a general mêlée of knights or squares or even a small mock battle in the lists.

Such were the tournaments of the later part of the Middle Ages. Their origin is obscure and they seem to have passed through a period in which they were contests in dress, combat and never a friendly contest for sport. It is thought they arose out of the old trials by ordeal (q.v.) and that at first they partook of a judicial nature. Certain it is that at first
were far more deadly than in later years for they were not uncommonly fought with weapons of war. Jousts of two kinds—the joute à outrance or combat, usually fought between two men of different nations and the à plaisir, the joust of peace which took place at the end of a tournament but which seems often to have been a staged contest in the nature of a duel, while jousts still retained the aspect of le combat to decide some question of ance, they lost their vicious nature and was rarely spilled. The passage of arms favorite practice of roving knights, a of whom would assemble at some place spend, each, several shields of different offering combat to any knight who ted himself. The accepier of the cha-struck the shield of the knight whom led to engage and the color and variety set for in a contest, had much to do with hastening dition, but it is probable that the change modes of warfare and the critical temper ed by the revival of learning were the causes of their abandonment. ord tournaments survive in modern con chess and checker play, tennis and other. The contests are entered, often classi to their ability and paired off for indi play until every player has met every player in the tournament. The one with thist percentage of wins is then declared tor and receives the first prize. Consult Gau thier's 'La Chevalerie'; Hallam's le Ages' and Viiolet-le-Duc's 'Diction du Figalier.'

TOURNIQUET, a contrivance for com a blood-vessel to stop the flow of blood putations and in dangerous hemorrhage wounds and to control the circulation a aneurism. It is believed to have rst used in France by Morel (1674). As this surgeon in amputations of limbs, ized of a stick passed beneath a bandage rised so that the tight knot would exert il pressure on the principal bleeding ves e rest of the bandage compressing the vessels of the limb sufficiently. At the time such a tourniquet is known as an ey tourniquet, which may also consist thing tied around the part above the in case of arterial hemorrhage (below, of venous hemorrhage) and twisted by of the tight knot is increased by placing a pad over air artery. Compression of a bleeding with the thumb or finner is of service a tourniquet cannot be obtained. Tourni quet of brass or copper, patented in from their inventors. Du Puyn's set consists of a semi-circular piece of with a head at one end and is used to s the abdominal aorta; Esmarsh's con

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sists of a piece of flat rubber tubing to be wound about the upper part of a limb, after the the blood has been driven out of the limb by elastic bandage or to be used by itself in compression of the iliac arteries, the abdominal aorta, etc. The field tourniquet, resembling Petit's spiral tourniquet, is a padded strap to be buckled on and pressed by a screw upon an artery. With the horseshoe tourniquet, named from its shape, pressure is exerted at two points. The provisional tourniquet is one applied loosely, to be tightened in case of necessity.

TOURO, too-ro', Judah, American philanthropist: b. Newport, R. I., 16 June 1775; d. New Orleans, La., 18 Jan. 1854. He was the son of Rev. Isaac Touro, who in 1762 was chosen rabbi of the Jewish congregation of Newport, R. I. The son removed to Boston, Mass., where he engaged in business with his uncle, Moses Hays, in whose employ he sailed to the Mediterranean in 1798 as supercargo. In 1802 he settled in New Orleans, where he became a wealthy merchant. He displayed his patriotism in the War of 1812 by furnishing the arms of the volunteer in General Jackson's army and was severely wounded at the battle of New Orleans. The range of his benevolence was very broad; families and individuals, churches and synagogues alike were enriched by him. Toward the erection of the Bunker Hill Monument he gave $10,000.

TOURS, toor, Berthold, Dutch composer: b. Rotterdam, Holland, 17 Dec. 1838; d. London, 11 March 1897. He studied at Leipzig and Brussels and going to London in 1861 became musical editor to Novello, Ewer and Company, 1878. His productions were principally religious in character and his 'Service in F,' 'Blessing, Glory, Wisdom and Thanks' and 'O Saving Victim,' were especially favorites. As a church composer he represented, with Stainer and Barnby, a new phase of English Church music which comprehends the introduction of new dramatic and melodic elements for which the entire school is probably indebted to M. Gounod.

TOURS, France, capital of the department of Indre-et-Loire, on the left bank of the Loire, at the confluence of the Cher, 130 miles southwest of Paris. The principal entrance to the city is by a magnificent bridge across the Loire, 1,423 feet long. The banks of the river are enclosed by a quay, lined with handsome houses and finely-plantcd promenades. Great part of the town is new and many of the streets are spacious and elegant; but the older quarters are inferior. The principal edifice is the cathedral. Its west front consists of three lofty, flamboyant portals surmounted by a window of astonishing dimensions and flanked by two domed towers, 205 feet high. The interior, of the purest Gothic, and lighted by beautifully stained glass, is 256 feet high in height. Two towers form conspicuous objects from every part of the town; one called the tower of Saint Martin or Horloge, from containing the principal clock; the other the tower of Charlemagne, or Eschard, was buried below it, and both remarkable as the only relics which the Revolution of 1793 have left of the vast cathedral of Saint Martin of Tours, after it had flourished for

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12 centuries. The archiepiscopal palace is regarded as one of the most handsome in the kingdom. It is the seat of a college, has other excellent educational institutions and a library of 175,000 volumes. The manufactures consist of silk stuffs, ribbons, cloth, serge, rugs, chemicals and leather, besides steel and ironworks and pottery, and the trade is in corn, wine, brandy, dried fruits, wax, hemp, wool, etc. Tours early acquired considerable importance and under the Romans was known by the name of Caesarodunum. It was from the gates of Tours that Charles Martel (q.v.) drove back the Moslem invasion of Europe in 732. In modern times it became famous for its silk manufactures and had so extended as to have a population of 80,000, when the Revocation of the Edict of Nantes deprived it of nearly half its inhabitants and almost all its industry and inflicted a blow on its prosperity from which it has scarcely recovered. During the Franco-German War Tours was made the seat of the government of France by Napoleon III on 12 Sept. 1870. The delegation removed to Bordeaux on 10 December. Tours surrendered to the Germans 21 Dec. 1870. Pop. 73,398.

TOURVILLE, too-voil, Anne Hilarion de Cotentin, Count de, French naval officer: b. 1610, at la Motte-Neuf, in Meulan, 24 Nov. 1642; d. Paris, 28 May 1701. He entered the navy in 1660, became a captain in 1667, participated in the battle of Agosta in 1670, and in command of the vanguard at the battle of Palermo in 1677 he destroyed 12 of the enemy's ships. He was appointed lieutenant-general of marine in 1680, commanded several expeditions against the North African pirates in 1682-88, became vice-admiral in 1689 and in 1690 was in command of the fleet which supported James II of England. He defeated a Dutch-English fleet off the Isle of Wight in that year, but in 1692 was ordered to attack a superior fleet off Cape La Hogue, in order to facilitate the landing of the Jacobites, and was defeated. He was created marshal of France in 1693 and in that year he captured and destroyed a Dutch-English fleet off Cape Saint Vincent. At the outbreak of the War of the Spanish Succession he was appointed commander-in-chief of the combined naval forces of France and Spain, but died shortly after.

TOUSSAINT, Anne Louise Gertrude, Dutch novelist: b. Alkmaar, 1812; d. 1886. She lived at The Hague after her marriage to the architectural painter, Jan Bosboom, in 1851 and became noted for her novels, especially her historical works. He "Het Huis Lauermesse" (1841; 10th ed., 1885) was translated into several languages and her "Leie-ster" trilogy became famous. Her works were collected in 25 volumes. Collectif Ten Bank, Jan, "Life of Anne Louise Gertruida Tou-sant" (Amsterdam 1886).

TOUSSAINT, too-sant, Francois Dominique, called L'Ouvriére, too-vair-teur, Haitian soldier and liberator: b. 1743; d. Port de Jacq, near Jacmel, Haiti, 27 April 1803. He was the first Haitian to fight against France when the insurrection of the blacks broke out in 1791 Toussaint took service in their army, but not till he had assisted his master to escape. He rose quickly in the army, being made in 1795 a general of brigade. In this position he displayed much military as well as political ability and rendered valuable services to the French republic against the British troops which had been landed on the island. In 1797 the French government made him general of division and subsequently general-in-chief of the troops in Santo Domingo, in which post he signed the convention with General Maitland for the evacuation of the island by the British. He now assumed sovereign authority, but it was only after severe struggles against insurrections that he was able firmly to establish his position. In 1800, on the submission of the Spanish forts, he was completely master of the island. He now framed a constitution by which he was appointed president for life of the republic of Haiti, with the right to name his successor. He was simple and abstemious in his own habits, but affected great magnificence in his surroundings and exacted a rigorous court etiquette. His character has been highly lauded by his admirers by Vanbeeck, the son of Anastasius, who made him the subject of one of his lectures. He ruled with wisdom and justice. Recognizing the failings of most of his own race he chose as his council white men with one exception. By his valuable administration the commerce as well as the agriculture of the island began to revive. After the Peace of Amiens Napoleon sent a powerful expedition under his brother-in-law, Leclerc, to subdue Toussaint, who after a stubborn struggle was forced to surrender and on his oath of fidelity was permitted to retire to his estate. He afterward detected conspiring against the French and being seized by a somewhat unworthy stratagem, was sent to France, where he died in prison. At the time a suspicion of poisoning was general, but there is no evidence to support it. Consult his "Memoires" (1833); the lives by Saint-Rémy (1850), Gragnon-Lacoste (1877) and Schechter (1889); Mosseil, "Tou-saint L'Ouvriere, the Hero of Santo Do-mingo" (Lockport 1896).

TOWAKONI, a sub-tribe of the Wichitan of the Caddoan linguistic stock of North American Indians, who in 1719 were found on the Cimarron, near its junction with the Arkansas in the present Creek Nation, Indian Territory. Later they were on the Brazos and Trinity rivers of Texas and in 1822 were reported to number 1,200. They made their first treaty with the United States in 1837. In 1840 they were said to have numbered 500 and to have resided on the Pecan branch of the Colorado River of Texas, but by 1850 their population was reported at 140 and their home on the Upper Brazos. They are now with the Wichitas on a reservation in Oklahoma, where they number about 130.

TOWANDA, tow-ahn-da, Pa., borough, county-seat of Bradford County, on the Susquehanna River and on the Lehigh Valley Railroad, about 50 miles north by west of Scranton. It is in an agricultural and stock-raising region and is the commercial and industrial center for a large portion of the country. The chief industrial establishments are planing-mills, furniture factories, wagon and carriage works, a large toy factory, a piano factory, foundries and machine shops. The water supply comes from springs 16 miles from the
The educational institutions are Susquehanna Collegiate Institute (Presbyterian), in 1850, a high school, public and parish high school library containing about 60,000 volumes and a college library. The two buildings have a combined capital of over $200,000.

**ER, Charles Magna, American diplomat.** Philadelphia, 17 April 1848. He was d at Harvard in 1872 and spent four years studying in Germany and Spain. After his return he settled in Philadelphia and in 1891 became active in business affairs and gave his time to historical studies. He became a member of the American Historical Society and was a contributor to the Quarterly Journal of Education. He was a prominent author and a contributor to several periodicals. He was the author of several works on the history of the United States, including a history of the Mexican War and a history of the War of 1812. He was also a contributor to the Quarterly Journal of Education.

**ER, Zealous Bates, American soldier.** Settled, Mass., 12 Jan. 1819; d. there, 21 Dec. 1890. He was graduated from West Point in 1841 and was appointed second lieutenant of artillery on the same day. He was made a major in the Mexican War in 1843 and served with distinction in the Mexican War. He was brevetted major in the Mexican War in 1861, and was killed in the first battle of Bull Run. He was a widely respected officer and a man of great ability.

**TOWER — TOWHEE BUNTING**

The round towers (q.v.) of India, Ireland and other countries. The tower bastion of medieval castles contained rooms and cells. (See BASTION). Water towers are similar to the round towers and were used for storing water. (See CAMPANILE; EIFFEL TOWER; PISA; MONUMENTS; RAGEA; TOPE.

**TOWER, Round,** a building peculiar to early Christian architecture, of slender form and usually having a conical roof. Windows are few in number and generally small. The type is common to Ireland, and in addition to the Irish bee-hive huts forms its only distinctive contribution to architecture. (See IRELAND, Architecture). More than 100 exist in Ireland. A few examples are to be found in Great Britain and on the Continent, pointing to the time of the invasion of the Irish missionaries. The smallness of the windows seems to make it improbable that the towers were used for bells and rather points to their employment for defensive purposes. The name is given to remains of the numerous round towers of the Pueblo type. They are found standing in isolation or in connection with walls of rectangular form. They are built of roughly-dressed stone and are interesting structurally for their three concentric walls, with the two outer ones connected by transverse walls on radial lines. See IRISH ARCHEOLOGICAL REMAINS; IRISH ART.

**TOWER BRIDGE, London.** See BRIDGE; paragraph Movable Bridges; also LONDON.

**TOWER CLOCKS.** See Clocks.

**TOWER OF LONDON.** See LONDON.

**TOWER MUSIC.** See CHIMES.

**TOWER OF SILENCE.** This name is applied to structures built by the Parsees for the disposal of their dead. They are towers—called dakhmas—about 40 feet high and with a large diameter. Somewhat below the top of the wall is built a floor of iron grating and upon this the bodies of the dead are placed until they decay and are removed. The bones are then placed in a pit below. There are evidences that they were carefully chained. One of these "towers of silence" stands in the neighborhood of Bombay, India. It is believed that their primary purpose was sanitary, to prevent contamination of local soil and water.

**TOWER OF THE WINDS, See ATHENS.**

**TOWHEE BUNTING,** a large, black, white, and chestnut bunting of the American genus Pipilo, several species of which occur in the United States. Several are confined to the southwestern United States, but one species, the chen-wing, or ground-robin (P. crypsithalamus) is numerous in summer throughout the whole of the eastern half of the country, and its sharp, metallic call is familiar to every countryman. In spring the male has a delightful song, but one not frequently heard. The nest of the towhee is made upon the ground in the woods, where the birds spend most of their time, scratching vigorously among the leaves for their food, and its five red-spotted eggs are cleverly concealed by a thickened and plumed canopy of twigs and leaves. Consult Wilson, Audubon and other writers on American birds.
TOWN, Ithiel, American architect: b. Thompson, Conn., 1784; d. New Haven, Conn., 1855. June 18, 1841. Alexander J. Davis he designed the old Capitol at Washington, the city hall at Hartford and the State capitol at Indiana and North Carolina. The town also designed churches at Hartford and New Haven and a bridge at Richmond, Va., over the James River. He was the author of a number of books on architectural and other subjects. His large library went in part to Yale College. He was one of the original members of the Academy of Design.

TOWN GOVERNMENT. See MUNICIPAL GOVERNMENT; TOWN AND TOWN MEETINGS.

TOWN AND TOWN MEETINGS. In its broadest meaning the word town denotes simply a collection of houses without regard to the size of the collection and without regard to the form of its political organization. In some sense a hamlet without any governmental powers at all of its own may be referred to as a town and likewise a great municipality like New York or London may be thus designated. In some of the Southern and Western States "town" is the legal designation of a municipal corporation whose powers are greater than those of a village and smaller than those of a city. In the New England States, while the word town is often used in a loose or broad sense, more frequently a town denotes a minor civil division (elsewhere called township) which is sometimes wholly rural, sometimes wholly urban and sometimes partly rural and partly urban. An advertised meeting of the voters of a New England town summoned for the consideration of local business is called a town meeting.

The Pilgrim Fathers who settled at Plymouth (1620) and the Puritans who settled (1628-30) at Salem and Boston began at once to develop a system of local government. They settled in compact communities and gave the name town to the thickly inhabited portion of a grant or purchase. The organization of the town was accomplished through the agency of a town meeting. The early settlers of New England were social rank; their average of intelligence was high; they were nearly equal in worldly possessions. Respecting matters of government, they were intensely democratic and at the same time intensely theocratic. They believed that the state should be a "city of God" and that authority in spiritual and temporal matters should flow from a common source. Accordingly their town meetings were religious assemblies acting as pure democracies, except in Rhode Island, where the civil authority did not interfere in matters of conscience. The meetings in colonies where the theocratic principle prevailed were usually held in a church, and all the male church members of the town who were of legal age could attend and take part in the discussions and vote upon any question that might arise. The town was incorporated and its boundaries were defined by the colonial legislature. It was then held that the church was a pretty church in its own way, providing, of course, it did nothing contrary to the laws of the colony. At first, while local government was getting under way, town meetings were called every month or two. In Boston in 1635 10 general town meetings were held. The people soon found, however, they could not give so much time to affairs and it was not long before it became the custom to summon the town meeting but once a year, provision being made for special meetings when there was need. These town meetings elected such officers as were required for the management of local business and made such by-laws as they thought necessary to the good of the community. For the management of the town during the interval between meetings a board of townsmen, usually selectmen, was elected. The number of men in the earlier towns ranged from 3 to 17. These officers administered the finances of the town, appointed subordinates, paid out contracts for public work and exercised powers as were necessary to secure and maintain the peace, safety, comfort and reformation of the people. As stewards of the people they gave to the town meeting an account of their stewardship in the form of an annual report. A town clerk, who acted as secretary of the meeting, was named by the recording officer of the town, and was responsible for the safekeeping of the records of the town, whose duties, broadly speaking, were that of a peace officer, were always in the hands of the selectmen, the clerk and the constables, the constitutive officers; no town was without them. Among other officers elected in the town meetings may be mentioned the town constable, who saw that the people came to church and with forward kept them awake during the sermon; the Constable, who supervised the erection of boundary fences between adjoining owners; the hog-reeve, who saw that rings were kept in good order; the driver, who impounded stray cattle. Representatives to the colonial legislature were elected in town meeting. Besides elected officers, the town meeting acted as a lawyer for all matters of local concern. It levied town taxes; it passed by-laws relating to the use of common fields and pastures; it assigned lands to individuals; it divided the province for the management and support of schools. In all New England colonies Rhode Island excepted, local government was regulated and controlled by the church, subject to the superior authority of the crown. No detail of the civil or religious life of the community was too small for the attention of the town meeting. It prescribed the manner in which the schoolmaster should be paid; it directed the arrangement of school buildings; it specified the hours of work which the woodman should begin to wield his axe.

Such was the early New England meeting. Its origin is traced by some of political science to the Anglo-Saxon and to the still earlier Teutonic manor. Early New England town certainly bore strong resemblance to the ancient type of Teutonic local government. The name "town" reminds us of the Saxon tun (Old English tun, a hedge); the selectman reminds us of the Saxon gerefa, headman (he was actually "headman" in Rhode Island); the town was, in many particulars, a counterpart of the Saxon Tunmoot. There is no evidence,
TOWN AND TOWN MEETINGS

The New England settlers consciously any existing or pre-existing type of government when they developed their town. They brought to their task English and English and shrewdly they domesticated English experience, own an institution, both in its origin and in its functions, was an outgrowth of the peculiar social, economic and conditions which prevailed in New during the first years of the colonial

own meeting system described above in the settlements of Plym and and Boston and was adopted by oots of the parent towns. When population of a grant or purchase sufficiently large to support a church and local government it was incorporated central legislative body and a town was called. Thus the town organization grew and was soon deeply affected by the affections of the people. It remained a society that was purely democratic any world had ever seen. During its early formative period its chief characteristic of New England life, and when the town came the little democracies proved vital aids in the cause of liberty. In meeting it could easily be learned who al and who were not. Through the town organization military stores were sold and the famous minutemen (q.v.) anarized. The resolutions of numerous meetings voiced in the plainest manner the sentiment for independence and the destruction of the Crown in favor of the measure, yeomanry of this selfish community en to overwhelm the Union. In another great Democrat says: "They [New towns] have proved themselves the experiment ever devised by the wit of the perfect exercise of self-government for its preservation."

Essential characteristics town government New England has not changed greatly days of the early settlers, except in its feature; that feature entirely disappeared in the early part of the 19th century, separation of Church and State was Details in the organization and in rs with the other New England States, yet the outlines of town government in all these States are practically and are as follows: The State legislates the boundaries of the town, and makes laws by which the town operates. As a result, the town can sue and be sued, acquire and hold real property. A be divided by the legislature into two townships or can be united with and made another town. The public affairs of another town. The public affairs of are transacted in a town meeting which meets annually, and also assembles in special meetings which may be called from time to time. The meeting is held in the town hall or in some other hall sufficiently large to accommodation. When a sufficient number of people have assembled, the town clerk calls them to order and states the purposes for which the meeting is called. A moderator (presiding officer) is then chosen and business proceeds according to parliamentary rules. All questions are decided by a majority vote of the qualified voters in attendance. Usually citizens who are qualified to vote for a governor and for members of the State legislature are also qualified to vote in town meeting. Here is democracy in its purest form. Young and old, rich and poor, the obscure and the prominent, are present, and every citizen may not only vote, but, if he chooses to do so, may also bring the full force of his character and influence to bear upon the delibera of the meeting. Routine business is quickly disposed of, but those matters which happen to be the subject of contention are generally discussed fully and freely. The right to vote on local taxation and assessments on the part of taxpayers. The finances of the town are watched keenly, and if there has been mismanagement or extravagance during the past year there is sure to be a merciless exposure in the town meeting. If improvements are needed or if the town is lagging behind its neighbors in progressiveness, the discussion in the folkmoot is likely to be directed toward a remedy. At annual town meetings the following things are done: (1) The rate of taxation for the coming year is fixed. Money is appropriated for the schools, the care of the roads, for the support of the poor, for the salaries of officers and for other necessary expenses. Sometimes the schools are managed by school districts. When this is the case each district elects its own officers and sometimes also makes its own levy, but the town meeting or town council elects the school superintendent. (2) By-laws are passed. These may relate to such matters as measures of general health, the erection of buildings, the regulation of the speed of vehicles. Many things which in other places are done by a body of chosen representatives are done in town meeting by the people themselves acting as legislators. (3) Town officers are elected. At the head of these stand the selectmen, or councilmen, three or five or seven in number. These are the executive officers of the town. They supervise the construction of roads, grants licenses, care for the poor, abate nuisances, check the spread of contagious diseases, listen to the complaints of those who have grievances of a public nature, select jurors, canvass the voting list, look after the paupers and represent the town in court wherever the different interest of the town may call. When a specified number of voters sign a call for a special town meeting it is the duty of the selectmen to act as the selectmen to place on the town post a warrant which calls the meeting and states the purposes for which it is called. After the selectmen, the town clerk is next in importance and usefulness. This officer calls the town meetings to order and keeps a record of its proceedings. In addition, he usually keeps a record of the births, marriages and deaths and grants certificates of marriages and the real estate records of the
TOWNE

town. Town assessors make out a list of the taxpayers of the town and place an estimate upon the value of their property. Sometimes the selectmen themselves act as assessors. In addition to the officers mentioned the town meeting usually elects tax collectors, a town treasurer, town solicitor, overseers of the poor, a school committee, trustees of the town library, constables (peace officers), surveyors of highways, fence-viewers, milk inspectors and field-drivers of the government's crops. At meetings of these officials to the town council. All town officers have a tenure of one year. The list of officers which has been given is not complete, yet it is long enough to show that in every New England community a great many people must take a part in public affairs. Undoubtedly it is this general participation in the business of government that makes the people of this part of our Union such a wide-awake and progressive body of citizens.

In all the New England States (Massachusetts excepted) the town is the unit for representation in at least the lower branches of the State legislature. Government in New England is, therefore, by towns rather than by counties. This is true in New England because the State has so many functions and absorbs so much local business that little is left for the county to do. Indeed the county in New England exists principally for judicial purposes; in Rhode Island it exists solely for judicial purposes. As it is 20 days a month it has always been throughout the whole period of its history the focus of New England life has been the town. *Towns,* says Joel Parke, "have been the arterial system of New England through which has circulated the life-blood which has invigorated, sustained and strengthened her, making her expand in her religious, social, educational, benevolent and political institutions." The people cling tenaciously to their town system. Boston did not change from town to city government until 1820 when, with a voting population of 7,000, she found that the town meeting could no longer act as a deliberative body. Yet the conditions of population in recent years sometimes make it difficult to transplant local government on the town plan. People are moving from the country to the city, depleting some towns and making others too large to meet in mass. Towns in New England vary in population from less than 100 souls to 20,000. As a matter of experience local government in New England is changing with the new conditions. So long as the population of a place remains below 10,000 (the population of Aristotle's ideal city) town government is usually economical, efficient and pure, but when the population greatly exceeds that number the interest of the citizens in local matters begins to flag, the town meeting becomes unmanageable and the town government often falls into unworthy hands. The remedy is municipal incorporation. The thickly inhabited part of the town secures a charter and becomes a borough or village or city and the people surrender a part of the public business to chosen agents. The town meeting does not extinguish town government within the boundaries of the new municipality, although it does take from it many of its former powers.

While town government in its pure form is found only in New England, modifications of it appear in those Western States where England emigrants, notably in Illinois, Wisconsin, Minnesota and . Each of these States has provided by a system of local government which is more or less closely the New England. In Michigan, for example, the voters township, after they have elected officers, meet in the afternoon in the transaction of certain local business. At meeting they may regulate the keeping of gunpowder, the licensing of the inhabitants; they may under certain restrictions, and the sale of books for the town may raise money by the purchase of books for the town. In Illinois, in those towns which adopted the township system, there is a meeting of the voters after the officers have been elected. Here we have at least of the town meeting, but it appears that the spirit of the New England vivifies these western meetings. A government in the West has always continues to be essentially representative. New England town meetings continue to-day, sometimes for two days, and attendance for so long a time means expense and money loss. Representative government, on the other hand, requires sacrifice. Because town government is much of the citizen's time and energy, and with such great responsibility, it has extremely difficult to transplant it. The of the town meeting has undoubtedly had an influence upon the course of local government in all parts of the Union, but it cannot be that town government, either in spirit, form, is vigorous in any State outside of England.


TOWNE, Henry Robinson, manufacturer: b. Philadelphia, Pa., 1844. He attended the University of Pennsylvania but left school to become a draughtsman in the Port Richmond Iron Works. In he was placed in charge of the steel shops and later, in 1864, was in building the engines for the iron works. He important work until the close of the course of time he took a special in physics at the Sorbonne, Paris, and became associated with Linus Yale in his famous locks, and after the latter was president of the company. Later he became chairman of the serve Bank of New York and was with other business interests. He is of Towne on Cranes (1883) : technical papers.
TOWNE SCIENTIFIC SCHOOL — TOWNSEND

TOWNE SCIENTIFIC SCHOOL, a department of the University of Pennsylvania. See Pennsylvania, University of.

TOWNELEY, Charles, English art collector: b. Burnley, Lancashire, 1737; d. London, 1805. He was educated at Douai College and began collecting art objects abroad in 1768. He made frequent trips abroad for the purpose. In 1791 he was made a trustee of the British Museum. His collection of marbles, known as "The Towneley Marbles," together with his statuary, medals and other gems of ancient art, was bought by the museum after his death. Consult Ellis, 'The Towneley Gallery' (London 1846).

TOWNELEY MARBLES, a notable collection of Greek and Roman sculpture, forming a portion of the gallery of antiquities in the British Museum; so named after Charles Towneley, by whom the collection was made.

TOWNSEND, Charles Elroy, American politician: b. Concord, Mich., 15 Aug. 1836. He was educated at the Jackson High School and at the University of Michigan, and was admitted to the bar in 1855. He was a delegate to the Republican National Convention in 1868 and served on the State, Central Committee (1899-1902). In 1903-11 he was elected a member of Congress from the second Michigan district, and on 18 Jan. 1911 was chosen United States Senator.

TOWNSEND, Charles Haskins, American zoologist: b. Parnassus, Pa., 29 Sept. 1859. He was educated at public and private schools and became assistant United States Fish Commissioner in charge of salmon propagation in California in 1883. He remained in the government service in various positions until 1902, when he was made director of the New York Aquarium, a position which he still holds. He is author of numerous monographs relating to fisheries, fish culture, etc.

TOWNSEND, Edward David, American soldier: b. Boston, Mass., 22 Aug. 1817; d. Washington, D.C., 13 May 1903. He graduated from West Point in 1837, served in Florida 1837-38 and on the Canadian frontier in 1838-41; was promoted captain in 1848 and colonel in 1861. In the year last named he made chief of staff to Lieut.-Gen. Winfield Scott. In March 1865 he was brevetted major-general United States army, and was placed on the retired list in 1880. He published 'Catechism of the Bible — The Pentateuch' (1859); 'Catechism of the Bible — Judges and Kings' (1862); 'Anecholes of the Civil War in the United States' (1884).

TOWNSEND, Edward Waterman, American author: b. Cleveland, Ohio, 10 Feb. 1855. He was for some years on the staff of the New York Sun and in 1895 became widely known by his "Pennsylvania, University of Major Max," in which a typical New York boy of the rougher class is depicted. Later works include 'Chimie Padden Explains, Major Max Expounds' (1895); 'A Daughter of the Tenements' (1896); 'Beavers and Leaven' (1903); 'Reuben Larkmead' (1905); 'Our Constitution' (1906); 'Beaver Creek Farm' (1907); 'The Climbing Courvatels' (1909).

TOWNSEND, George Alfred, American journalist: b. Georgetown, Del., 30 Jan. 1841; d. 15 April 1914. He was graduated at the Philadelphia High School in 1860 and entered journalism. He was special war correspondent of the New York Herald and World in 1861-65, afterward engaged as a lecturer, and in 1866-67 he was in Europe as special correspondent in the Austro-Prussian and later at the Paris Exposition. For many years after 1868 he was an editorial writer and correspondent on the staff of the Chicago Tribune, and his contributions to the press, under the penname "Gath," have been widely read. His publications include 'Campaigns of a Non-Combatant' (1863); 'The Real Life of Abraham Lincoln' (1867); 'Washington Outside and Inside' (1871); 'Tales of the Chesapeake' (1880); 'The Entailed Hat' (1884); 'President Cromwell' (1885); 'Mrs. Reynolds and Hamilton' (1890); 'Columbus in Love' (1892); 'Poems of Men and Events' (1899); 'Poems of the Delaware Peninsula,' etc.

TOWNSEND, Lawrence, American diplomat: b. Philadelphia, 13 Aug. 1860. He was educated at the University of Pennsylvania and spent some six years in Europe in the study of international law and the history of the Hague Peace Conferences. He was first secretary of the American legation at Vienna 1893-97, Minister to Portugal 1897-99 and Minister to Belgium, 1899-1905.

TOWNSEND, Luther Tracy, American Methodist clergyman: b. Orono, Me., 27 Sept. 1838. He was graduated from Dartmouth in 1859 and from Andover Theological Seminary in 1862, served in the Federal army during a portion of the Civil War, and in 1864 entered the Methodist ministry. He was professor of Hebrew in Boston University 1868-70 and of practical theology there 1872-73. He has since been professor emeritus. He has published among many other works 'Credo' (1869); 'Bible Theology and Modern Thought' (1883); 'Evolution of Creation' (1899); 'God's Goodness and Severity' (1903); 'God and the Nation' (1903); 'Doctrine of the Trinity' (1903); 'Bible Studies' (1913); 'God and War' (1915); 'Hell Is No Myth' (1917).

TOWNSEND, Thomas Seaman, American compiler: b. New York City, 27 Aug. 1829; d. there, 1908. He was given a classical education but devoted himself to commercial life. His renown rests chiefly on a compilation of newspaper clippings relating to the Civil War which fills 125 large volumes and forms a mine of information for the historian of the times from 1860 to 1901. The collection is in Columbia University Library and is entitled the 'Townsend Library of National, State and Individual Civil War Records.' He also lectured and gave addresses on the War of the Rebellion.

TOWNSEND, town's-end, Charles, 2d Viscount, English statesman: b. Rainham, Norfolk, 10 March 1674; d. there, 21 June 1738. On the death of his father, the first viscount, in 1687, he succeeded to the peerage and took his seat as a Whig in the House of Lords, 1695. He was one of the commissioners for arranging the Scotch Union (1706), was joint plenipotentiary with Marlborough in the conference at Ge rtruyen burg (1709), and as ambassador to the States-General signed the Barrier Treaty at The Hague, 29 Oct. 1709. He was
censured by the House of Commons for this action and declared an enemy of the queen and kingdom. He accordingly entered into correspondence with his elector of Hanover, who, on his accession as George I, appointed Townshend his Lord Chamberlain. In 1713 he was made privy councillor and in 1714 he was appointed lord-lieutenant of Ireland; was again Secretary of State from 1721 to 1730, when he retired by reason of disputes with his brother-in-law and colleague, Sir Robert Walpole.

TOWNSHEND, Charles, English statesman: b. 29 Aug. 1725; d. London, 4 Sept. 1767. He was grandson of the 2d viscount Townshend, was educated at Leyden (probably also at Oxford) and entered Parliament in 1747. The next year he received a minor office and in 1754 became Lord of the Admiralty. From this post he rapidly advanced and became a member of the Privy Council in 1757, Secretary at War in 1761, and in 1766 Chancellor of the Exchequer. Pitt's entrance into the House of Lords and eventual incapacity through ill health left Townshend virtually at the head of the government and he held his nominal chief in determining the right of the East India Company to territorial revenue and made use of his official position to secure for himself a large share in a public loan. In 1767 he was defeated on his proposition for a land tax. On 13 May he introduced measures dealing with the American colonies, virtually reviving the principles of the Stamp Act, which had lately been repealed. The American Revolution was caused by the imposition of taxes which he proposed. His reputation as an orator was scarcely second to that of Pitt himself. Of his qualities Lecky has written: "Exuberant animal spirits, a brilliant and ever ready wit, boundless facility of repartee, a clear, rapid and spontaneous eloquence, a gift of mimicry which is said to have been not inferior to that of Garrick and Foote, great charm of manner, and an unrivalled skill in adapting himself to the moods and tempers of those who were about him, had made him the delight of every circle in which he moved, the spoil child of the House of Commons."

TOWNSHEND, Sir Charles James, Canadian jurist: b. Amherst, Nova Scotia, 22 March 1844. He was educated at King's College and became a noted barrister. He was at one time a member of the law faculty at King's College and practiced successfully as an attorney. He was a puisne judge (1887), and since 2 Nov. 1897 has been chief justice of Nova Scotia. He was knighted by King George in 1911. He was conservative member of the House of Commons (1884-87) and held other positions of honor. Among other papers he is the author of "A History of the Courts of Judicature in the Province of Nova Scotia."

TOWNSEND, Charles Vere Ferrers, British soldier: b. 1861. He joined the army in the Royal Marines in 1880 and was a major-general in 1911. His life was one of active service and he was at the front in the Boer War and compelled to surrender at Kut el Amara for lack of food after a five months' siege by the Turks. Previously he had served in the Sudan and Nile expeditions (1884-85), participated in the South African War (1899-1900) and was with the British army in India (1907-09).

TOWNSHIP, a local minor civil or political division of territory within a county in the United States, outside of New England, where they are termed towns. See TOWN AND TOWNSHIP MEETINGS.

TOWNSLEY, Clarence Page, American army officer: b. De Kalb, N. Y., 24 Sept. 1845. He was educated at the West Point Military Academy by the United States Military Academy at West Point (1872-76) and was appointed to the 30th division, National Guard, in 1917.

TOWNSVILLE, Australia, the most important town of northern Queensland, Australia, situated on Cleveland Bay on the east coast. It has a number of fine buildings, including a new cathedral, the Supreme Court building and a large prison. The chief industrial establishments are an iron foundry, an ice plant, a soap factory and meat packing houses. The town has a good harbor and well fortified; it is the terminus of a railroad to Hughenden and the chief outlet for the products of northern Queensland. The Great Commonwealth Bank has a branch here. The exports amount to nearly $15,000,000 annually Pop. 13,835.

TOWSE, John Ranken, American drama critic: b. Stratham, England, 2 April 1845. He was educated at Cambridge University and came to New York in 1869. He took up newspaper work and since 1874 has been dramatic critic of the "Evening Post." He published "Six Years in the Theatre: an Old Critic's Memories" (1913-16).

TOXICOLOGY, the study of poisons. The word poison is difficult to define, since many substances which in minute amounts exert no harmful action on the body may in large quantities produce disastrous effects. Then, again, some substances which are harmless when taken into the stomach, as water, for instance, injected into a blood-vessel prove very dangerous, causing death at times from the destructive action of the water on the blood-cells. Moreover, the many studies of recent years on bacteria and other forms of life have resulted in a new series of conceptions regarding the poisonous actions of the compounds formed by these bodies; and further, certain forms of perverted metabolism of the human body result in the production of certain products which, retained by the body, work harmful effects. (See AUTO-INTOXICATION; METABOLISM.) If all the different factors are taken into consideration, a strictly scientific definition of the word poison cannot be given. In general it is said that a poison is any substance which brings about a change in the molecular composition of an organ or organs, causing its functions to depart very disagreeably from the normal. But what grade of molecular disturbance is necessary to make a substance a
poison, or how far from the normal must be the functional alteration, it is impossible to say. Many substances, strychnine for example, while being distinctly poisonous in appreciable doses, are very useful and helpful to the body when given in small amounts. Infinitesimal doses of some copper salts act as pronounced poisons on certain forms of lowly organized plants, while a higher plant, the potato, does not suffer from large doses used as a spray to kill insect or fungus parasitism.

The modern conception of poisonous action is essentially a physico-chemical one, the distinction between a molecular physical action and a molecular chemical action being difficult to make. But it is believed that for practically all forms of poisons a distinct alteration in the character of the cells of the body takes place, as well as a change in the chemical composition of the poisonous substance. It is impossible at the present time to summarize these changes. It is rare that the reaction between the body-cell and the poison is purely of a physical nature, yet this very frequently happens in many poisons that act on the blood. By some of the poisons—the anilines, for example—the blood undergoes changes not so much due to new chemical compounds formed, as to physical changes in the tension of the blood-serum and the blood-corpuscles, whereby the blood-coloring matters stream out into the plasma, and the oxygen-carrying function of the blood is lost. Similar types of poisoning result from some of the metals, and the poison of the cholera organism is thought to act in a like manner. In other poisons there is a direct union of the ions of the poison with some constituents in the cells of the body, making new chemical compounds, and thus interfering with the molecular activities of the cells. Von Jaksh has divided the poisons into two classes: the exogenous poisons, or those that come from without the body, and enter by way of the skin, the lungs, the stomach or the intestines; and the endogenous intoxications that result from changes within the human body through disordered metabolism. Occurrence of former causes serious changes in the body that death results from an intoxication of the second variety. Thus a severe irritant to the kidneys, such as cantharides, may cause such an acute inflammation of that organ that it cannot secrete urine, and the patient may die of uraemic poisoning. In much the same manner certain bacteria find entrance into the body and develop poisons both within the tissues and also in the intestinal canal, and furthermore provoke putrefactive processes in the food in the intestinal canal. This brings about a triple form of poisoning, as it were.

The different types of poisoning are many. They cannot be given here, but are available, but the symptoms and general treatment of a few of the more common types of poisoning will be mentioned. Poisoning by the mineral acids, nitric, sulphuric, hydrochloric, is not uncommon. In these there is a marked caustication; there is marked pain when taken by the mouth. The lips are stained yellow, black or white respectively, according to the acid taken. There is nausea, vomiting and diarrhoea, with all the symptoms of an intense gastro-enteritis, with collapse, pale face, cold sweating extremities, small, feeble pulse, rapid respiration; and the patient dies in intense agony. Treatment is by prompt washing out of the stomach with an alkaline solution, soap, washing soda or other mild alkali being useful. Then comes the use of several nauseating drinks, such as white of egg, gum arabic, slippery elm, olive oil, milk, etc. The technical details require prompt medical attendance as soon as the washing out with the alkaline solution is commenced.

Oxalic acid is frequently swallowed by mistake. Here the staining is usually absent; the gastro-enteritis is marked as in poisoning with the mineral acids; there is great muscular weakness and twitching of the muscles, particularly about the face; sometimes there are convulsions and further symptoms of collapse are present. In treatment wash out stomach by tube, or by drinking large quantities of water with lime— half a teaspoonful of lime to quart of water. Following oxalic poisoning large quantities of water should be taken for a week or so to flush the surplus oxalates from the kidneys.

Poisoning by alkalis is infrequent. Occasionally sodium hydrate, or potassium hydrate, is swallowed. Lime is also taken by accident; so (rarely) is ammonia. The symptoms are much like those of poisoning by the mineral acids. There are no marked discolorations, as noted, but otherwise the symptoms are similar. Treatment is by rapid washing of stomach with weak acids, vinegar being the most convenient, and by demulcents, as in acid poisoning.

The halogen compounds are very markedly poisonous as gases, notably chlorine, bromine, fluorine; and the iodides and bromides cause forms of chronic poisoning known as iodism and bromism (q.v.).

The heavy metals as such are not poisonous, but their soluble compounds are all poisonous. They vary widely, however, in strength. In order, from the strongest to the weakest, they are caustic or astringent; severe caustic metallic salts being, in order, mercury, tin, silver, antimony, copper, zinc. The salts of iron are not very poisonous. But in poisoning the acid part of the salt is of importance. From strongest to weakest these acids run: hydrochloric, nitric, sulphuric, phosphoric, acetic, citric, tartaric. If a caustic metal is combined with a caustic acid the resulting salt, if soluble, is a very powerful poison, mercuric chloride, or corrosive sublimate, being an illustration. If a weak metal like iron is combined with a strong acid the result is an intermediate poison like chloride of iron; when a weak metal, as lead, is combined with a weak acid, as acetic, lead acetate, sugar of lead, a weak poison, is formed. Thus the strength of a metallic salt may be calculated from the use of a neuter, or mucilaginous, and acid ions. In all these metallic poisons albumen compounds are formed. The coagulum varies in all and according to its solubility or insolubility the burning of the poison is more or less deep. In all the symptoms are analogous; the use of a neuter, or mucilaginous, with symptoms of collapse. The treatment is similar in all: washing of the stomach, white of eggs, milk, demulcents, artificial heat, respiration and afterward careful feeding.

Arsenic and phosphorus are poisons that
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give very similar symptoms: acute gastro-enteritis, with nausea, vomiting, purging; then some grade of apparent recovery, to be followed after a few days with a recrudescence of the gastro-enteritis and the development of secondary blood-vessel changes, which may cause minute hemorrhages in any part of the body. Then follow fatty degeneration and death. The commonest form of salt causing arsenic-poisoning is Paris green; while rat-poison and matches are responsible for most cases of phosphorus poisoning. Treatment of arsenic poisoning calls for prompt washing of the stomach, small doses of magnesia and water every 15 minutes for several hours and stimulant supportives. Phosphorus can usually be detected by the odor. There should be prompt washing, and avoidance of oils, although castor-oil may help in getting phosphorus out of the intestinal canal. Authorities, however, prefer the saline cathartics. A prompt oxidizing agent, permanganate of potash or hydrogen peroxide, should be used, or small doses (1 to 2 grains), diluted, of copper sulphate.

For the effects of poisoning by the alcohols, see AlCOHOLISM. Practically all of the anaesthetics (ether, chloroform, ethyl chloride, etc.) and hypnotics (chloral, paraldehyde, trional, sulphonal, veronal, etc.) belong to the alcohol group (see ALCOHOL), and the symptoms are closely allied.

Phenols form a distinct group in which carbolic acid, creosote, phenol, cresol, pyrogallic acid, thymol, guaiacol, naphthaline, salol, etc., belong. They cause symptoms closely resembling one another. Carbolic acid may be taken as the type. This causes gastro-enteritis, with severe pain, white scar of lips and throat, breathing, dizziness, smoky to blackish urine, pale, bluish face, weak heart, quick breathing, coma and sometimes convulsions. Treatment is by quick washing of the stomach. A mixture of lime and sugar of syrupy consistency, Epsom salt, milk, white of eggs, cardiae stimulants and artificial respiration are all valuable.

Another large group of poisons, the anilines, includes many of the modern drugs, such as acetanilid. Closely allied are different amine dyes. Also phenacetin, antipyrin. In these characteristic signs of poisoning are somewhat similar to those seen in the phenol group, but in the more pronounced ones of this series the main changes occur in the blood. There is blueness of the skin and lips, difficulty in breathing, sometimespinkish to purplish urine, rapid and feeble heart action. The chief changes are due to a partial destruction of the red blood-cells. In phenacetin the blood rarely disintegrates as in antifebrin or acetanilid; whereas in antipyrin there is no real blood alteration. In most of these forms is the prompt evacuation, cardiae stimulation, oxygen and, most important of all, artificial respiration.

Alkaloid poisons (seeALKALOIDS) are numerous. The commonest forms of poisoning from these, the most powerful poisons, are morphine (opium, laudanum, paregoric), strychnine (pox yonica), atropine (bella- donnium, cocaine [coca], aconite [aconite] and nicotine [tobacco]). In acute opium poisoning the classical symptoms are drowsiness, coma, small pin-point pupils, loss of pain, slow breathing (six to eight to a minute), moist skin, dry mouth, rousing with more or less active consciousness and quick relapse. Treatment is by washing the stomach with hot strong tea or coffee, by mouth or by rectum, and by artificial respiration. Too much walking of the patient about is not desirable.

Strychnine poisoning causes twitching of muscles, cramps, irregular muscular movements, convulsions at slightest jar or touch, fixation of muscles of breathing, with cyanosis. Treatment is by great quiet, alcohol, chlorine and stimulants.

Belladonna poisoning shows wide-awake, restless consciousness, sometimes active, busy delirium; dry mouth, skin hot and flushed, pupils widely dilated and paralyzed to light and accommodation, rapid feeble heart and rapid respiration. Treatment is by prompt evacuation of stomach, sodium bromide, opium, caffeine or coffee.

Another group of glycoside poisons is characterized by a great similarity in action. Many of these are used in medicine and some were used as arrow-poisons by wild natives. The group contains digitalin (digitalis), strophanthus (strophanthus), convallarin (lily-of-the-valley). Bryonin (bryonia), apocynin (dogbane), oleandrin (oleander), scillain (squill), etc. These are all heart poisons. They first quicken the heart, then slow and regulate it, hence their usefulness in many heart diseases; but in overdose they paralyze the heart by overstimulation. At these drugs rarely cause poisoning, the treatment is omitted.

Tox albumins form a group of special character, and all are very violent. Some are of vegetable and others of animal origin. The most important are abrin (in jequirity-seeds), ricin (from the seed-coats of the castor-oil bean—frequently causing death in children who eat the whole bean), phallin (in poisono mushrooms), rattlesnake poison, cobra poison, heloderma and the poison of lizards, etc.

The most important of the bacterial toxins, some of which might be classed here, are discussed under their respective heads. For the endogenous intoxications see the articles on the infectious diseases, tuberculosis, pneumonia, tetanus, typhoid, etc.; also the diseases of metabolism, uraemia, diabetes, Basedow’s disease, Addison’s disease—thyroidism, myxedema, cretinism, etc. See TOXINS AND ANTITOXINS.


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TOXINS AND ANTITOXINS

Mitchell and Reichart (at the University of Pennsylvania) first demonstrated that the poisonous constituents of snake venom are proteins, or closely related bodies. This statement did not meet with favor in Europe, especially in Germany, at the time, but further studies have confirmed it and it is now a well-established fact that some of the most powerful poisons known are proteins, or at least so closely associated with proteins that all attempts to obtain them free from proteins up to the present time have failed. Such bodies have been found in animal, vegetable and bacterial life, but are limited to certain genera and species. In 1887 Sewall (at the University of Michigan) reported a research which should be recorded as the first step in the discovery of methods of securing immunity to the action of these protein poisons, now known as toxins. Sewall studied the effects of the venom of the rattlesnake on pigeons. Finding that the minimum fatal dose of this poison was at first administered less than this quantity, and, by gradually increasing the dose, established an immunity which enabled the pigeons to bear without apparent harm many times the minimum fatal quantity. That the time appreciated the possible bearing and significance on protection against disease of his results is shown by the following quotation from his report: "This work was undertaken with the hope that it might form a worthy contribution to the theory of prophylaxis. I have assumed an analogy between the venom of the poisonous serpent and the ptolemae produced under the influence of bacterial organisms." In 1891 Ehrlich, in a similar manner, succeeded in establishing in animals a high degree of immunity against two of the most potent protein vegetable poisons—ricin, from the castor bean, and abrin, from the jequirity bean. One gram of ricin is sufficient to kill one and one-half million guinea pigs, and the potency of abrin is about one-half that of ricin. To these poisons immunity, as Ehrlich demonstrated, is easily established by feeding the animals by the mouth upon small and gradually augmented doses of these poisons in the venom from snake venom in being absorbable from the alimentary canal, the resemblance in potency and in the production of immunity is striking. Moreover, like snake venoms these are protein poisons. Ehrlich made two important advances over preceding workers. He found that the immunity produced with these substances is specific. An animal immunized to ricin has no immunity to abrin, and vice versa. It was later found that this specificity holds good with all poisons of this class. In the second place, Ehrlich found that the blood serum of the immunized animal contains the immunizing agent, and that transfusion of this serum to a fresh non-treated animal confers a passive immunity upon the recipient. Moreover, this transferred immunity is quantitative. If the first or actively treated animal has been given an immunity of 10 times the fatal dose, and no more, then one-tenth of its blood will be required to give the fatal animal one minimum lethal dose, while if the actively treated animal has been immunized to 100 fatal doses, one-hundredth of its blood serum will immunize a fresh animal to one fatal dose, and one-tenth of its serum to 10 fatal doses. Furthermore, he found that the immunity of an actively treated mother may be transferred to the nursing young through the milk. Roux and Yersin of the Pasteur Institute found that cultures of the diphtheria bacillus, especially cultures four or five weeks old, when freed from the living organism by filtration through porcelain, contain a poison similar in many respects to snake venom and the vegetable products ricin and abrin. The bacteria—free cultures—when injected into guinea pigs even in minute doses, killed the animals in the same time and with the same symptoms and lesions that result from inoculation with the living organism. Von Behring later immunized larger animals, first goats, then horses, to filtered diphtheria cultures, and demonstrated that the blood of animals thus immunized has both protective and curative value in the treatment of diphtheria. The toxin obtained at the minimum fatal dose of this culture of the diphtheria bacillus at 38°C for two weeks or more and then removing the bacteria by filtration. In other words, diphtheria toxin is an old filtered culture of the diphtheria bacillus. The potency of the toxin and the duration of the toxins, all of which must be considered when one attempts to secure a highly active product. The medium generally employed for the growth of the diphtheria bacillus consists of beef tea containing 1 per cent of sodium chloride, from 1 to 3 per cent of peptone, and made feebly alkaline with a solution of sodium carbonate. This medium is placed in glass flasks, each of which should not be more than one-third full in order that there may be a large surface exposed to air which favors the growth of the bacillus and the production of toxin. The flasks are inoculated by floating small masses of diphtheria bacillus growths, taken from agar tubes, on the surface of the beef tea in the flasks. After having been thus inoculated, the flasks are kept at 37°C for about 14 days, when they are filtered and the filtrate constitutes the diphtheria toxin. The toxin solution quickly loses its potency when freely exposed to the air. If properly protected it remains without material deterioration for months, and under most favorable conditions, for years. Protection is secured by covering the toxin solution kept in dark bottles with a layer of toluol. In this way both air and light are excluded. Protection is made more complete by keeping the bottles in a dark room, the temperature of which does not rise above 15°C. When portions of the solution are to be used, withdrawal is made by means of a pipette. The precautions which has caused the toxin solution may be kept without marked loss in toxicity for two years or even longer. Before the toxin prepared as stated above is used in the preparation of antitoxin, its strength must be determined. This is done by ascertaining the minimum amount of it necessary to kill a guinea pig of from 200 to 300 gram-weight within from three to five hours. This amount is known as the minimum lethal dose. When most laborers engaged in the preparation of diphtheria antitoxin, the toxin is not regarded as sufficiently
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potent unless the minimum lethal dose does not exceed 0.02 cubic centimeter. However, it is not always easy to secure a lethal dose of the toxin. Weaker solutions may be used. Occasionally a much stronger product is obtained, and when this happens the preparation is greatly prized and carefully kept under the conditions mentioned above. Horses free from disease are carefully selected by skilled veterinarians. Usually they are submitted to a malein test to be sure that they are free from glanders. During the procedure the animals should be carefully guarded against wounds however slight, since these may serve as ports of entry for tetanus infection. Into these horses the toxin solution is injected, at first in small amounts. The first dose is usually followed by a transient disturbance in health. This may be slight, and indeed may not be in evidence at all. However, often after the first dose the animal's coat roughens, the appetite is impaired, and it may show some elevation of temperature. When there is complete return to health, usually after three or four days, a second injection of the toxin is made. It is safer to make the second injection no larger than the first. Indeed, the practice is to make the second injection slightly less than the first. In this case there is usually no recognizable disturbance in the well-being of the animal. After the third or fourth treatment the quantity of toxin used can be rapidly increased and it soon develops that the animal bears without apparent effect many times the amount which if used without previous treatment would have caused death. After this condition of immunity has been secured, a portion of blood is drawn from a vessel in the neck of the horse, allowed to coagulate, and the separated serum tested for its antitoxic strength. This process is known as the standardization of the antitoxin. The procedure consists in ascertaining how much of the blood serum of the treated horse is necessary to neutralize 100 minimum lethal doses of the toxin. The serum of the horse and the toxin are mixed in varying proportions in vitro, and the mixture injected into guinea pigs of from 200 to 300 grams weight. The amount of toxin taken in these mixtures represents 100 minimum lethal doses, and the minimum amount of serum which must be added to this so that the mixture will have no effect on the guinea pig is known as an immunity unit. It will be seen from what has been said that the filtered culture of the diphtheria bacillus constitutes the toxin, while the blood serum of the immunized horse constitutes the antitoxin. Both of these are standardized, and one neutralizes the other quite as effectively as acid neutralizes alkali. Diphtheria antitoxin, which is the blood serum of an immunized horse, is put on the market in tubes fitted with hypodermic needles and ready for use without transfer. This avoids the possibility of contamination after the preparation leaves the last preparation of the manu-

According to Wernieck's saving of lives during the first year of the use of diphtheria antitoxin in Germany amounted to 20,000, and if the agent were promptly and properly used the saving of lives would amount in that country to 45,000 annually. The value of diphtheria antitoxin is even greater than is indicated by the lowering in the death rate from this disease. For every sick child treated with antitoxin, on an average five are saved from being sick. While the curative value of antitoxin is great, its preventative value is still greater. The diphtheria physician called to a family in which one child has diphtheria gives a curative dose of antitoxin to the sick child and immunizing doses to the others. Even when the sick child has been neglected so long that the curative value of the antitoxin is lost, its preventive value in the others is still potent. Diphtheria antitoxin has lowered not only the mortality rate but still more the morbidity rate. In 1880, before the discovery and employment of this agent, deaths from diphtheria in the registered area of the United States amounted to 112,600 per 100,000; in 1913, after the general employment of diphtheria antitoxin, it was 18.8. Certainly it is no exaggeration that the discovery of diphtheria antitoxin is one of the most beneficent of the achievements of modern life, and it could not have been made without animal experimentation. The preparation of this agent necessitates the sacrifice of the lives of hundreds of guinea pigs, and it leads to the saving of the lives of thousands and tens of thousands of children.
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State and municipal laboratories are employed in the detection and recognition of diphtheria, and antitoxin is furnished free to the physician when the measured amount is to be used. When a physician sees a case which he suspects to be diphtheria he makes a swab from the throat of the child and transfers this in a sterilized test tube to the municipal laboratory. Here the culture is made and after 12 hours a positive statement can be furnished as to the nature of the disease. Even this delay is unnecessary if the physician is sufficiently confident that he has a case of diphtheria to deal with. Under proper precautions there is no danger in the administration of this agent. In the more enlightened communities school medical inspectors are constantly on the watch for the first evidence of this disease and the child of the poorest citizen is transferred and treated in a municipal hospital with as much skill and care as the richest can secure. Since diphtheria toxin has not been obtained in a pure state, its nature, so far as its chemistry is concerned, remains unknown. There is still doubt as to its just in what group it should be classified. Usual methods of purification have been tried, but preparations have been secured which do not respond, altogether at least, to these tests. The molecular weight of the toxin is much less than that of the antitoxin because the former filters readily through porcelain and diffuses quickly through gelatin, while the antitoxin is largely removed from solution by filtration through porcelain and does not diffuse through gelatin. From these facts it is inferred that the molecule of the antitoxin is much larger than that of the toxin. The toxin is highly susceptible to heat, a temperature of 60°C. being sufficient to markedly reduce, although it does not wholly destroy its toxicity. A like effect is induced by the presence of both mineral and vegetable acids. Even lactic and tartaric acids speedily render it inert and its toxicity is reduced, although not completely destroyed, by borax and boric acid. It is highly susceptible to the action of oxidizing agents such as potassium permanganate. A 1:10,000 solution of lime is retained, and when passed through parchment but does not pass through animal membranes or colloidon sacs. It is insoluble in alcohol, and prolonged contact with this agent destroys its toxicity. It is also robbed of its virulence by the digestive ferments present in the alimentary canal, and therefore is harmless when taken into the mouth, provided there is no break in the continuity of the mucus membrane. From solution it is carried down mechanically on the addition of calcium chloride, which precipitates calcium phosphate. In this respect diphtheria toxin closely resembles the enzymes. There are other respects in which this resemblance is evident. Some of these are as follows: (1) It is destroyed by heat; (2) in its purest state it contains no fermentative or reproductive character of proteins; (3) it is active in high dilutions; (4) it is a product of cell activity; (5) when introduced into the body there is a period of incubation before the development of its effects; (6) when introduced into animals in progressive or acute doses it leads to the production of an antibody.

The chief objection to accepting the theory that toxins are enzymes or ferments lies in the fact that in their action on animals and in their reactions with their antibodies their effects may follow the laws of chemistry, but follow the laws of multiple proportion. In other words, the toxins do enter into the reactions and are exhausted or neutralized in doing so. On the other hand, the weight of evidence is that enzymes or ferments do not enter into the reactions caused by their presence but that they are not consumed in such reactions. For instance, the hydrolytic enzymes, such as diastase and pepsin, cause starch and protein to take up water and pass over into sugar and peptone while the enzyme itself does not enter into the reaction and is not consumed in the process. It might be stated differently as follows: An enzyme changes the tempo of a reaction which would more slowly occur without its presence, while a toxin combines with its antibody much as an acid combines with an alkali.

When a fatal dose of diphtheria toxin is injected into a susceptible animal, such as a guinea pig, there is a period of incubation during which the animal shows no marked departure from the normal. The onset of the first symptoms, such as fever, loss of appetite, and death of the animal, varies somewhat with the size of the dose, but is never less than about eight hours, even when many times the fatal dose has been used. However it should not be inferred that nothing happens during this period of incubation. The disturbance simply does not rise to the plane of gross clinical observation. The toxin begins to act soon after its introduction into the body. Within an hour or two the clinical thermometer, which is not a highly delicate indicator of changes in temperature, shows an elevation which proceeds slowly until a short time before death, when there is a progressive and rather rapid fall in temperature which may reach some degrees below normal before death. The skin about the point of injection becomes edematous and later necrotic. The interval between injection of the toxin and death is the same as after inoculation with the living organism. When sublethal doses are given there is often paralysis, beginning in the posterior extremities and proceeding over the body. The internal organs are hyperemic, with minute hemorrhages in the adrenals, stomach and intestines. Occasionally a gastric ulcer is produced. Diphtheria toxin apparently has a special avidity for nervous tissue. Whether this action is primarily central or peripheral has not been satisfactorily determined, though it is most probably the latter. When the toxin is injected into a susceptible animal it soon disappears from the blood stream and manifests its activity on certain organs and tissues. It has not been found in the urine except when massive doses have been given. In unsusceptible animals it remains for a long time in the blood stream and is of course without action on the tissues, susceptible, while rabbits are less so, and white mice practically refractory.

The toxin is a secretion of the living bacillus...
and different strains of the organism vary widely in the amount of toxin which they elaborate. There is apparently no constant and fixed relation between the virulence of a given strain of the bacillus and its toxin production. A strain isolated by Park of New York, and generally known as Park No. 8, has proved in both American and European laboratories to be a most efficient toxin producer. It was obtained from a relatively mild case of diphtheria and it has shown no great virulence as tested by the experimental inoculation of guinea pigs. With this strain filtered products have been obtained with as low a minimum lethal dose as 0.0015 cubic centimeter. However this strain sometimes fails to produce a satisfactory toxin. Through another strain Madsen once reported a toxin whose minimum lethal dose was as low as 0.0005 cubic centimeter. This is the most powerful diphtheria toxin yet reported. The cellular substance of the diphtheria bacillus contains a protein poison, as was first shown in the writer's laboratory. Against this poison diphtheria antitoxin has no neutralizing effect and it must be regarded as a pure death. A true type toxin results only when the word toxin has come to have a distinct and specific meaning. All toxins are poisons, but all poisons are not toxins. Those poisons which when injected into animals in gradually augmented doses produce antibodies are known as toxins. The serum of horses immunized to diphtheria toxin, and known as diphtheria antitoxin, is usually preserved by the addition of 0.5 per cent phenol or 0.3 per cent tricresol. For the antitoxin to be of value it must neutralize the antitoxin on account of the large size of its molecules. Heating antitoxin to from 60° to 70° C. destroys its value, but the dried antitoxin will bear a temperature of 110° C. for half an hour without injury. Diphtheria antitoxin is quite certainly a protein. It is true that it bears some resemblance to ferments. It is in and of itself perfectly harmless to the animal body. All disturbances which may result from the administration of diphtheria antitoxin are due to other constituents of the serum and may be induced by the use of the serum of a normal horse. The antitoxin may be precipitated from the serum by metallic salts as other protein constituents are, but it is not carried down mechanically as happens to the toxins and the ferments. It is more than probable that the antitoxin is a globulin. It is precipitated with this protein fraction, and the precipitated antitoxin has been prepared by this method. Unfortunately the immunity induced by diphtheria antitoxin is only temporary, lasting from three to four weeks, while one attack of diphtheria does not give immunity to another. For this reason it frequently happens that a child who has once had an immunizing dose may, a few months or possibly a few years later, need a curative dose. The fear of anaphylactic shock has led many physicians to hesitate about a "reinjection" of horse serum after an interval of 10 days or more of the bacillus and its toxins not to do this with safety. In all cases of "reinjection" after an interval of 10 days or longer one drop of the antitoxin should be administered and if no untoward symptoms follow within an hour, any amount of the serum may be injected with safety. This procedure should be adopted not only in all cases of "reinjection" but when the patient has shown at any time asthmatic symptoms. With these precautions no physician need fear to use diphtheria antitoxin in the treatment of this disease. When antitoxin is used early in the disease the extension of the membrane in the throat usually stops in a few hours. For this reason laryngeal diphtheria is now rarely seen except in neglected cases. Not only does the extension of the membrane stop on the administration of the antitoxin, but as a rule that already formed begins to recede, becomes detached and fades away.

In all civilized countries the manufacture of diphtheria antitoxin is under government control. In the United States this is one of the functions of the United States Public Health Service. No one can manufacture diphtheria antitoxin without a permit from this service and such permits are not granted until personal inspection has convinced the service of the reliability and scientific intelligence of the manufacturer. Besides this, every batch of diphtheria antitoxin prepared is tested not only by the manufacturer but in the Hygienic Laboratory at Washington, D.C. It is essential that the preparation and standardization of so valuable an agent as this should be under government control.

Tetanus, or lockjaw, is one of the most strikingly distressing and fatal diseases known. Therefore it is not strange that it is mentioned in some of the earliest medical writings. It was known to the writers of classical times that tetanus was in some way connected with working and that it was much more common in military than in civil life. Furthermore, it has long been known that the frequency of the development of tetanus does not run parallel with the extent or gravity of the wound. Indeed it is more likely to result from a trivial penetrating wound than from a large open one. The infectious nature of this disease was first demonstrated by French physicians, especially Verneuil. However the experimental transfer of tetanus was first made by two Italian physicians, in 1884. They inoculated 12 rabbits with matter taken from a pustule on a man who had tetanus. Within a few days 11 of these animals developed the disease, and from these it was transferred to other rabbits. Soon after Nicolaï induced tetanus in rabbits, guinea pigs and mice, by inserting bits of earth under the skin. This investigator also discovered the specific bacillus, but failed to separate it from associated bacteria. This was done by a Japanese bacteriologist, Kitasato. The tetanus bacillus develops spores which are highly resistant to heat and other adverse agents and may retain their vitality quite indefinitely. In some localities 100 per cent of rabbits inoculated with the soil develop this disease. As a rule the spores are most abundant in filthy soil, especially that richly impregnated with horse manure. Before the days of aseptic surgery tetanus was especially prone to follow operative procedures, as was one man, who, after being operated upon by a great surgeon, and many other operators both in the field and in hospitals. Among certain primitive dirty people tetanus of the newly born is frequent on account of the methods of cutting and elevating the cord. On certain islands, as Réunion and Cayenne, the infantile
rate from this cause has in some years
s high as 50 per cent. In other localities it
works havoc among women in the
third month of pregnancy. A tribe with
arrowheads with mud rich in tetanus
The marked mortality from Fourth
y celebrations in this country a few years
as due to tetanus infection. Fortunately
tribal superstitions were allowed to
s to celebrate the birthday of our na-
ave been beneficially modified, largely
h the knowledge spread by the Journal
American Medical Association. The
of our country most abundantly infected
his virus seem to be the Atlantic States,
ly Long Island and the Valley of the
Commercial gelatin and catgut used
geons have been the bearers of this in-
and, most thorough sterilization is neces-
it order to destroy the spores. Formerly
ake of idiopathic and traumatic tetanus.
we are quite sure that the former does
ess. The wound may be so trivial that it
led before symptoms of the disease
p. Some cases embrittle not be
skin, but on a mucous membrane, as in
uth, nose or throat. The writer saw a
which the virus had entered through the
rom which a tooth had been extracted.
been claimed that tetanus is more preva-
black and mixed races than among
and, some have endeavored to show the
ce of racial susceptibility. The truth is
liness is the predisposing agent rather:
racial difference. The simple custom
ing the wash by spreading the clothes on
ound has been found to play a part in the
nce of this disease. The distribution
tetanus virus seems to be world-wide.
been found in every land, in the temperate
nd zones at least, and in many waters
those of Lake Geneva and the Dead
May be present in bilge water and
ships have been infected from this

Many years ago on an English ship
naval battle 16 of the wounded died of
s. It may be carried into wounds with
infected clothing or with the dirt on
in, and it has been, found on nearly
article worn by the soldier, from his
his collar. Virgin forest soil has gen-
been found free from this virus, but in
ings from the streets, stables, houses,
d and cars frequently produce tetanus when
seed under the skin of animals. Of our
ic animals, the horse is the most sus-
e and is a frequent victim. The ox,
next, followed closely by sheep and
Dogs and cats are not easily infected,
suffer to inoculation. When swallowed,
anus bacillus has no effect unless there
re a state of inflammation involving the
aces unchanged. In th
by the fecal matter of men and animals
s the soil.
anus toxin, one of the most potent
stitute a state of expanded peritoneum, the
bacillus in bouillon or blood serum un-
aerobic conditions. The bacillus is re-
filtered and the filtrate constitutes
. It is of delicate nature and is easily
ved by both physical and chemical agents.
and is rapidly rendered innocuous by the
aturation of the culture both light and
air should be excluded. According to Kitasato,
exposure to sunlight completely destroys the
toxin within from 15 to 18 hours. Other
vestigators have reported the time to be only
half of this. Oxidizing agents such as dilute
solutions of potassium permanganate, mineral
and vegetable acids, destroy it promptly. From
its solution in the filtered cultures tetanus toxin
is thrown down on the addition of ammonium
sulphate, and by dialysis and evaporation in
vacuo it can be obtained in dry form, not pure
but mixed with the proteins carried down
it with the reagent. The purest preparations
yet made still give the protein reactions and
there are those who claim that the toxin is an
albumose, but this does not necessarily follow.
According to Brieger and Cohn, the fatal dose
for a mouse is about 0.0000005 gram and for a
man, about 0.00023 gram. It requires 2,000
times as much of the poison per kilo of body-weight
to kill a rabbit as it does to kill a horse, and the
chicken is 100 times less susceptible than the
rabbit. It is highly poisonous when introduced sub-
cutananeously or intravenously, but is most
potent when administered subcutaneously and
tradrubercularily. This is due to the fact that it
has a predilection for nervous tissues. It has
been shown quite conclusively that when in-
fected subcutaneously the toxin is conveyed
to the nerve centres through the axis cylinders
of the motor nerves, and that symptoms of
tetanus first develop when the anterior horns
of the spinal cord are reached. This explains
why there is always a period of incubation,
both after subcutaneous injection of the toxin
and as a result of wound infection with the
bacillus. It also makes plain the observation
so frequently recorded that the period of incuba-
tion is shorter the nearer the site of in-
oculation is to the central nervous system.
That tetanus toxin does combine with certain
constituents of the central nervous system was
demonstrated some years ago by Wassermann
who found that when the toxin is rubbed up in
a mortar with brain or spinal cord tissue it
is completely fixed and neutralized. In other
words, it forms a compound with some con-
stituent of this tissue. This is probably what
happens when the poison is generated by the
bacillus in the animal body and as a result of the
injury thus caused to the nervous tissue
tetanic spasms occur. The tetanus antitoxin is
prepared in a manner similar to that employed
in the preparation of diphtheria antitoxin.
Unfortunately, however, the brilliant practical re-
ults obtained in the treatment of diphtheria
have not been secured in the treatment of
tetanus. The value of tetanus antitoxin as a
protective agent has been recognized for many
years and has been fully confirmed in the
treatment of the wounds of the World's War.
Before the United States entered the War,
American laboratories were busy supplying the
armies of the Allies with this material. Sol-
diers received a protective dose before they
went into battle and all wounded were treated
with this agent as soon as possible. In this
way a high death rate from tetanus has been
avoided, notwithstanding the fact that a large
proportion of the wounds are infected with the
bacillus. If one waits until symptoms of
tetanus have developed the administration of
the serum fails in a large proportion of cases
in effect a cure. However, even under
this condition the treatment is not wholly without value. The cessation of trench warfare was followed by a notable decrease in the number of cases infected with the organism of this disease.

In certain parts of Germany, especially in Württemberg and neighboring parts of Baden and Bavaria, where sausage, a favorite article of diet, has been improperly cured and eaten raw, poisoning from this article of food has long been known. Rarely, similar cases have occurred among those in the United States who persisted in the Old World method of preparing and eating sausage. As a rule, food which produces this form of intoxication has been prepared for a long time before it is eaten. The disease thus produced is known as botulism and it should be clearly understood that this does not include the ordinary form of food poisoning which leads to vomiting and purging and generally ends in recovery. In 1885, some 30 cases of botulism developed in a small Belgian village and were studied by Van Ermengem of Ghent. In this instance, the food was a ham which had been boiled in brine. It was from a sound animal, other portions of which had been eaten while fresh without harm. In fact the companion ham, from the same brine, had been eaten without disturbing those who had partaken of it. The sound ham lay near the surface and was not wholly covered by the brine while the faulty piece lay on the bottom of the vat and was completely excluded from the air. It was not noticeably decomposed, but was marked by so-called "spotted" areas and gave off butyric acid. In this meat the bacillus botulinus was found. An aqueous extract of the ham was injected into animals and proved to be intensely poisonous. In cats it caused dilatation at animal temperature, but at lower temperatures and when the air is excluded it develops its toxin. It will be seen that it does not cause an infection but an intoxication. Indeed, the bacillus does not multiply in the animal body, to a slight extent. It is a toxigenic, rather than a pathogenic, organism. A striking characteristic of this toxin is that it affects some animals, including man, when taken by the mouth. It also has a predilection for nervous tissue. According to Marinexco and others, it induces in the blood cells of the anterior horns, leading to chromatolysis, and disintegration of Nissl's granules. Like tetanus toxin, it combines in vitro with nervous tissue, forming an inert compound. An effective antitoxin has been prepared and has proved efficient in animal experimentation. The writer is not aware that this antitoxin has been used in the treatment of botulism in man. The toxin may occur in canned vegetables as well as in meats. There was quite a scare in the United States in 1917 concerning the possibility of botulism being widely prevalent on account of the new methods of preserving food proposed at that time by the Agricultural Department. This scare has been greatly reduced by subsequent events. Apparently the bacillus botulinus is not widely distributed. So far it has been found only once except in food and that was in the faces of hogs. As has been stated, it grows only in the absence of air or in association with other organisms which consume the air, and it has been found in canned foods. In such, it produces gas which bulges the ends of the can and food from such containers should not be eaten. In brine of more than 10 per cent strength it will not grow. It is of special interest because it is essentially a saprophytic organism producing in food in the absence of air a most potent poison which affects man when taken into the stomach.

Reference keys in diet have been found. Reference keys to the fact that the toxins were first found in the venom of snakes. Antitoxins to these venoms have been prepared, their value demonstrated experimentally on animals, and some slight use of these preparations have been made in the treatment of men bitten by poisonous snakes in India. However, these antitoxins like all others are strictly specific and an antitoxin must be prepared for the venom of each species of poisonous snake. The rarity of death from the cause in most parts of the world and the difficulty of preparing and keeping on hand an antitoxin for the treatment of the bite of each species limits the use of this preparation. Within recent years an antitoxin has been prepared and used successfully in the treatment of cerebrospinal meningitis. In this instance a definite amount of fluid is withdrawn by puncture under aseptic precautions from the spinal canal and is replaced by the injection of the antitoxin. Furthermore, it has been demonstrated in our own camps during the war that the intravenous injection of this antitoxin is beneficial.

Scientific investigations and extensive studies on animals have given to man absolute control of diarrheal and enteric diseases as typhoid fever and its Tuberculosis, formerly known as the "C" of the Hosts of Death, has been greatly reduced.

In the Rockefeller Institute there has been prepared a serum for the treatment of all forms of pneumonias recently induced by staphylococci groups may cause. Animals have been immunized to this organism and the sera of such animals have been used in the cure of this disease. However, it is not certain at present that such sera have true antitoxic values. Some claim that the sera of animals immunized with this type of pneumo-
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coccus have a bactericidal action, while others think that they only render phagocytic action more effective. In order to be of service in the treatment of pneumonia due to pneumococcus Type I, a relatively large amount of the serum must be used. In other words, a certain degree of concentration must be reached. The law of multiple proportion which holds good between diphtheria toxin and its antitoxin fails here. Our experience in the World War has demonstrated the great destructiveness of the pneumonias and the lesson that we have learned should lead to the greatest effort toward the discovery of both preventive and curative measures in these diseases. On the battlefields of France the gas bacillus, known also as the Welch bacillus, proved a most distressing and destructive agent. Shortly before the war closed Bull and Fritchett at the Rockefeller Institute discovered an antitoxin for the poisons of this organism and fully demonstrated its value in experimental animals. The cessation of trench warfare led to a rapid reduction in the number of wounds infected by this organism and the time has not yet come for a correct estimate of the practical value of the antitoxin. See IMMUNITY; MEDICAL SCIENCE AND THE WORLD WAR; SERUM THERAPY.

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TOXODON, a genus of large Pleistocene mammals whose complete remains are found in the Paleozoic formations of Argentina. They were about the size of a hippopotamus; the teeth consist of large incisors, very small lower canines and strongly-curved molars, all with persistent roots. According to Cope, the tarsal bones more nearly resemble those of the Proboscidea than any other known ungulates. With a smaller genus, Nesodom, it constitutes the sub-order Toxodontia.

TOY, Crawford Howell, American Oriental scholar; b. Norfolk, Va., 23 March 1836; d. Cambridge, Mass., 12 May 1919. He was graduated at the University of Virginia in 1855, studied in Berlin (1860-68), and became professor of Hebrew in the Southern Baptist Theological Seminary in 1869 and professor of Hebrew and other Oriental languages and lecturer on biblical literature at Harvard in 1880. From 1899 until his death he was professor emeritus. His published works include 'The Religion of Israel' (1882); 'Quotations from the Old Testament in the new Testament' (1884); 'Judaism and Christianity, a Sketch of the Progress of Thought from Old Testament to New Testament' (1890); 'Hebrew Text and English Translation of Ezekiel' (1899); 'Commentary on Proverbs' (1899); 'Introduction to the History of Religion' (1913), and others.

TOYAMA, to-yā-mā', Japan, the capital of the prefecture of Toyama, situated near the head of Toyama Bay, west coast of Nippon, 170 miles northwest of Tokio. It has considerable trade in drugs and leather. Pop. of the city about 64,822; of the prefecture, 829,596.

TOYBEE, to'īn-be, Arnold, English social economist and philosopher; b. London, 23 Aug. 1852; d. London, 9 March 1883. He was interested in various movements of popular re-
form and the betterment of the laboring classes. Though called a socialist, he was certainly a conservative one and vigorously opposed in two lectures the doctrines of the 'Progress and Poverty' (1880) of Henry George (q.v.). Toynbee Hall in Whitechapel, London, was established in his memory in January 1885 and was the first "universal settlement." His writings were posthumously collected as 'The Industrial Revolution' (1884; 4th enlarged ed., 1894). Consult Montague, 'Life' (Johns Hopkins historical series, 1889); Milner, 'Arnold Toynbee: a Reminiscence' (1895).

TOYBEE HALL, a social settlement, the first in the world, founded by Canon S. A. Barnett in memory of Arnold Toynbee, who, while a student at Oxford became interested in the White Chapel district poor. The settlement was opened in 1884 and was a success from the start, gradually becoming a centre of educational and social endeavor and rallying to its work many of the leading young men of the time. Consult Gell, Philip L., 'Account of the Work of Toynbee Hall in East London' (Baltimore 1889). See SOCIAL AND UNIVERSITY SETTLEMENTS.

TOYS, American Manufacture of. To tell the story of the art of toy-making from its earliest days it would be necessary to follow the industry back through many centuries, for the archaeologists, in delving among the tombs of ancient Greece and Egypt, have made the surprising discovery that children played with dolls—and jointed dolls at that—more than 5,000 years ago. Moreover, by the side of these dolls the scientists have unearthed other playthings that children still crave: dolls' furniture, the utensils for cooking and for keeping shop, and, what is perhaps more interesting from the point of view of the antiquarian, the articles used by the priests in making the sacrifices, cleverly duplicated in miniature, showing that the children of those times also played at having religious exercises for the benefit of their doll's soul.

Scientists now claim that the custom of playing with dolls is one that is practically as old as the world itself, and that they base their assumption upon the theory that playthings are always and always have been just as necessary a constituent of human health and development as either food or medicine. The most eminent modern psychologists support this theory. They claim that the reason why children crave toys is that their nature requires them, and that to deprive them of such playthings is to retard their mental growth and development.

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In spite of the early origin of toys the progress in the manufacture of playthings was so slow that even as late as 100 years ago they were few in number, simple of construction and extremely costly, especially in the United States. At that time no such articles were systematically manufactured in this country, and as the cost of importation added materially to the price, there were comparatively few persons who were financially able to purchase such puppets for their little ones. Instead, the children of those days accepted more primitive playthings — dolls that were often not dolls at all, but pieces of cloth, either folded and pinned in such manner as to suggest the "shape" that was not there, or with head and bust stuffed hard with sawdust, the features being indicated by pen and ink drawing. In addition to these dolls there were a few other toys that could be purchased for children, but hoops, jumping-rope, ten-pins, marbles, jack-in-the-box, the battledoor and shuttlecock, a few simple games, some roughly illustrated books, alphabet blocks, etc., represented the limit of the toy-sellers' stock.

In America is concerned the toy-making industry is of so recent an origin that it can scarcely be said to have a history. Before 1875 more than 90 per cent of the toys sold in this country were of foreign manufacture, and we have made no attempt to export such few articles as we did make into other countries. To-day, on the other hand, scarcely 5 per cent of the toys we sell are made abroad, while our exports are increasing rapidly.

To obtain anything like an accurate idea of the great progress that this nation has made in the art of toy-making it is necessary to remember that up to about 1875 there was not a doll factory in the United States, and that such other toys as were manufactured in American turning mills were cheap in quality and unprepossessing in appearance. When the American manufacturers began to make toys, about a quarter of a century ago, they found that it would be extremely difficult for them to compete successfully with the foreign toy-makers in the field in which they had been so long. In the first place material was cheaper in Europe, and there could be no comparison between the comparatively good wages paid to workmen in this country and the miserable pitance allowed in those German and Swiss villages where the entire population was held under contract to produce such goods at prices that barely enabled them to keep body and soul together. To overcome this difficulty American inventive genius was called into play, with the result that the local manufacturers not only established many new lines of toy specialties but that they evolved countless ingenious contrivances that the foreign producer has never dreamed of making.

Thus we still import some dainty toys from France and Switzerland, nearly all the newest and most unique productions are now made in America.

Simple toys are made mostly of wood and metal, using the same principles employed by mechanical engineers in the making of delicate machinery. The design has been decided on and reduced to its most simple elements, gigs are fashioned so that each piece is a duplicate of every other piece, and the construction is pushed through on the American factory system. Many toys are really model machines, as steam-engines, locomotives, cars, carriages, fire-engines, automobiles, tanks, etc.; others are mere figures or puppets, as the Noah’s ark men, wooden soldiers and the like; others are miniatures of common household articles, as chairs, tables, plates, cups, spoons, etc., assured to be proper for the furnishing of a doll’s house. Others are very elaborate and costly as a goat’s carriage, peddle mobiles, working locomotives, contractors’ machinery, imitation large figures of elephants, dogs and Teddy bears, hobby horses, etc. Some single toys in playthings sell at retail between $1.00 and $20.00, which is not considered extravagant by the rich.

The United States census compiles together the manufacturers of toys and games. It is not possible wholly to separate the two, but it appears that there were in 1914 about 200 establishments wholly devoted to toy-making, and as many more partly devoted to the industry, which gives employment to about 5,000 persons, with annual products valued at $8,000,000.

TRACERY, in architecture, permanent openwork in a window, the top of a doorway, etc., characterized by geometric and ornamental management of the prominent lines of the design. It is common in the cathedral structures of Europe, especially in the older French and Italian structures. The term is extended to similar decorative work of a conventional character, as on a dado or ceiling decoration.

TRACHEA, trä’kē-ə or trā’kē-ə, or WIND-PIPE, the principal air-passage of the body; a tube extending from the larynx to a point opposite the third dorsal vertebra, where the tube divides into two chief divisions or bronchi, one of which supplies each lung with the air necessary for respiration or breathing. The trachea is of cylindrical form and is both membranous and cartilaginous in its structure. Its length is about four and one-half inches and its diameter from three-fourths inch to one inch; that of the male being larger than that of the female. The front or anterior surface of the organ is convex and is covered in the chest by a thick layer of fat about the ishmus of the thyroid gland, the inferior thyroid veins, the sternohyoid and sternothyroid muscles, the first part of the sternum, the arch of the aorta, etc. The trachea rests on the gullet or esophagus, while in the chest it is situated between the pleura or membranes lining the thorax and has the pneumogastric nerve on each side. The trachea is composed of rings or zones of a gristy or cartilaginous nature, known as the cartilages of the trachea. It rests on the gullet or esophagus, while each cartilage forms an imperfect ring, being unenclosed behind and having the gristy edges merely joined by fibrous membrane. The cartilages are separated from each other and also connected together by narrow bands of fibrous tissue. The first cartilage of the trachea is broader than the others and may be divided at one extremity, while the last cartilage is thick in the middle and curved backward at the point where the trachea divides into the two bronchi. Sometimes two of the cartilages may be united. The muscular fibres of the trachea exist in longitudinal and transverse layers and are composed of unstriped or non- striated fibres. (See Muscu-
TRACHEOTOMY—TRACT SOCIETIES

The trachea itself is lined by a mucous membrane, which is covered with ciliated cells provided with delicate vibratile cilia or cilia. The trachea derives its blood supply from the inferior thyroid arteries. Its nerves come from the pneumogastroneous trunks and cervical sympathetic ganglia.

Foreign bodies falling into the trachea usually enter the right bronchus, because of the larger size of the latter and because the more oblique position of the left

Intracranial and Injuries of the Trachea.-Achea is liable to inflammation and its contents and frequently suffers from extension of disease from the larynx. Acute inflammation may occur as an idiopathic affection or as a complication of other disease, as smallpox, measles, tuberculosis, whooping cough, and may extend to the submucous and cartilaginous structures, giving rise to ulceration, cicatrisation and stricture. Effusion in the larynx and the application of the application of steam may result in the larynx. The inhalation of steam may cause laryngeal edema and the administration of antiphlogistic remedies. Constriction of the trachea due to a foreign body or other causes pressing against the trachea; or the symptoms produced by pressure on the nervous system.

Foreign bodies occasionally pass through the larynx into the trachea and the accident is a formidable, which not infrequently proves fatal. Accidental death occurs most frequently among children and is caused by a sudden inhalation of a foreign body, something in the mouth. Occurrence, however, a foreign body may, during swallowing and without an inhalation under the epiglottis and into the upper larynx. Foreign bodies in the windpipe are arrested above the rima glottidis, in the vocal cords, in the cavity of the oropharynx or in the trachea. In such cases the patient is suddenly seized with convulsive coughing. The speech is more or less affected and the breathing is whistling or stridor; but the diagnosis rests mainly on the presence of the symptoms. When the foreign body is made out, it is to be removed at once.

When the body is in the trachea, a free opening lower be at once made and the opening be either longitudinal or transverse. It is advisable to insert in nearly all cases to the trachea, as, by securing a free aperior or respiration, spasm of the glottis is avoided, and the foreign body may be removed through the artificial opening, or it may fall into the mouth. Fracture of the cartilage from direct violence and in cases the wounded part should be left open, so as to secure the passage of air to the lungs. Union of the wound by sutures is avoided, that by suppurative inflammation. Foreign bodies in the trachea and all kinds of injury from external violence are serious affections, as disease of the lungs is apt to be induced.

The term trachea as applied in respect to invertebrates connote a more or less complicated arrangement of air-tubes and spiracles (q.v.), most fully developed in insects and constituting the respiratory system. See INSECT; see ANATOMY; LUNGS; NOSE AND THROAT; RESPIRATION.

TRACHEOTOMY. See Nose and Throat.

TRACHOMA. See Ophthalmia.

TRACHYTE, trak'te, an igneous or pyrogenic rock of the effusive type and consisting of a ground mass of slender hair-like crystals of orthoelastic feldspar and ferro-magnesian silicates (hornblende or augite) and generally phenocrysts of sandine feldspar. It differs from rhyolite chiefly in the absence of quartz. Trachyte occurs in the Black Hills, in Custer County, Colo., in Montana, along the river Rhine, where the Drachenfels furnishes the most typical variety, in the Auvergne, in Italy, and in the Azores. The compact pre-Tertiary varieties are classed as felsites (q.v.) or porphyries.

TRACING PAPER, transparent paper which enables a drawing or print to be clearly seen through it when laid on the drawing, so that a pen or pencil may be used in tracing the outlines of the original. It is prepared from smooth, unsized, white paper rendered transparent by an oil application, as of oil of turpentine with an equal part of Canada balsam, nut-oil, etc.

TRACT NUMBER 90. See TRACTS FOR THE TIMES.

TRACT SOCIETIES. The circulation of religious appeals in writing preceded the invention of printing and was used by Wycliff and other reformers at times and places when and where open preaching might have been too perilous. The press was able to multiply such appeals and it was largely used for this purpose in the religious controversies of the 16th and 17th centuries. The 17th century and the beginning of the 18th witnessed the organization of several societies within the Church of England for promoting Christian knowledge and the dispersion both at home and abroad of Bibles and tracts of religion.

It was not, however, until 1750 that members of different Protestant denominations united in London to form the "Society for Promoting Religious Knowledge Among the Poor." This and other societies with a similar object circulated many religious books and tracts.

In the United States the Methodist Book Concern, established in Philadelphia, issued its first publication in 1789, and removed to New York in 1804. In 1822 a bindery was established and in 1824 a printing office was added. The division of the Methodist Church on the slavery issue led to the establishment of a separate book concern at Nashville, Tenn., by the Methodist Episcopal Church South. The publications of the Book Concern are of three classes—first, the bound volumes, denominational papers and some pamphlets; second, those of the Methodist Episcopal Sunday School Union, and third, those of the Episcopal Tract Society. The Concern has developed far beyond the "tract society," being now a
large religious publishing house. The salaries of bishops and other expenses of the Methodist Episcopal Church are paid out of the profits of the Book Concern.

The American Tract Society was founded in the spring of 1825. In this society Christians of different Protestant denominations united to publish and circulate “whatever would best diffuse a knowledge of our Lord Jesus Christ as the redeemer of sinners and promote the interests of vital godliness and sound morality,” the material circulated to be such as would receive the approbation of all evangelical Christians. The society established a system of colportage, gave wide circulation to tracts and sought to place Christian literature in every family. Periodicals were established for young and old and the needs of the large foreign population were met by religious publications in their own languages. The society has contributed from its earnings nearly $1,000,000 to assist missionaries abroad in printing books approved by the society. Donations and legacies the society has received over $7,000,000 and has expended that amount in its gratuitous work, besides printing and circulating over 800,000 tracts, pamphlets, books and periodicals, many of which were sold. Among the nationalities reached in their own languages by publications of the American Tract Society are the Swedish, Danish, French, Spanish, Dutch, Italian, Portuguese, Polish, Bohemian, Hebrew, German-Hebrew, Hungarian, Lithuanian, Finnish, Welsh and Armenian. It has furnished religious reading matter to the American soldiers in large quantities. Besides the American Tract Society, every important denomination has an organization for the circulation of its denominational literature.

TRACTARIANISM, the name usually given to a system of religious opinion and practice promulgated within the Church of England in a series of papers published under the title of ‘Tracts for the Times,’ between September 1833 and March 1841. The immediate object of the movement was to secure the admission of a large number of nominal adherents of the Church of England from their apathy, by awakening their interest in what the writers conceived to be the distinctive principles of that Church. For this end, the refugees from the Roman Catholic Church, the German, and the French Protestant creeds were the subjects of special attention. It was not until the development of dynamo-electric power, and the experience so gained, that the practical application of the system to the purposes of cultivating and maintaining the loyalty of the converts to the Church of England from the Roman Catholic Church, the German, and the French Protestant creeds was possible. After that, electric machinery had improved before electricity could compete with the existing means of traction. Among the leaders in this movement were J. H. Newman, John Keble and E. B. Pusey, and they were assisted by not a few of the writers of the Tracts for the Times, who, while suppressing the revolutionary doctrine of the Tractarians, did not rest content with the narrow limits of their own creed. The Tractarians believed in the truth of the old religion, and the maintenance of spiritual unity with the Church of Rome, and the restoration of the visible unity of the Church, as the only way to secure the establishment of the true religion and the salvation of mankind.

TRACTATION, Electric. The development of electric traction was started with experiments on a small scale, involving no practical outcome, followed by failures on a larger scale, showing the possibility of the system, and finally by success and the practical application of the system to the purposes of transportation. It was not until the development of dynamo-electric power made it possible to obtain electrical energy at reasonable cost that the practical application of electric traction became possible. After that, electric machinery had improved before electricity could compete with the existing means of traction. Among the leaders in this movement were J. H. Newman, John Keble and E. B. Pusey, and they were assisted by a few of the writers of the Tracts for the Times, who, while suppressing the revolutionary doctrine of the Tractarians, did not rest content with the narrow limits of their own creed. The Tractarians believed in the truth of the old religion, and the maintenance of spiritual unity with the Church of Rome, as the only way to secure the establishment of the true religion and the salvation of mankind.
the development of electric roads in the United States has been rapid. At first horse tramways were equipped to operate by electric trolley roads, then the tramways were extended further to the suburbs and surrounding towns, and towns were connected by interurban roads equipped electrically, runned at the Sprague speed and starting and stopping on steam locomotives. For city train service on elevated roads, the substitution of electricity has taken a longer time, as the steam locomotives were efficient and as the changes involved an expenditure which would not have been advisable unless decided advantages with respect to service and cost of operation were shown.

Direct-current Railway Motors.—On all the electric roads in this country, and on a large proportion of those abroad, direct-current motors are used for traction. These motors are of the series type, and are usually connected to the axle through a single spur gearing. The characteristics of the direct-current series motor are admirably adapted to traction work. The speed is dependent upon the tractive effort, and the motor slows down when the tractive effort increases, having something of the effect of a variable speed gear; this is very important in practical railway work, for if the motors ran at a constant speed, the energy demanded on grades would be greatly exaggerated and much larger motors would be required. It is also true that this type of motor gives a greater flexibility to the system, as far as the speed is concerned, and this flexibility is important in practical work. To show the difference between a series motor and a shunt motor, suppose the track resistance is 10 pounds per ton weight of the car; then if the speed were constant (as would be the case with a shunt motor), the power required on a 5 per cent grade would be 11 times as much as on a level—air resistance being omitted—while with a series motor it would be only three or four times as much.

It might be well to briefly trace the development of electric railroad motors in the United States. The motors used by Sprague in the equipment of the Richmond road had too small a variable resistance and the work was burned out. They were two-pole machines, of a rated capacity of 7.5 horse power, and at first drove the axle through a single reduction gearing; the work, however, was so heavy that it was found necessary to change to a double reduction gearing, the teeth of the pinion stripping on the heaviest grades. These motors were unprotected from moisture and from the dust and dirt of the streets. The methods of suspending the motor and some of the details of the regulation are still retained. The field magnets of the motor were sleeved on the axle, thus centering the armature on the axle and allowing a satisfactory relation between the two. The brushes had no drag, the commutator, which was soon abandoned, as it greatly increased commutator troubles, which were at that time serious. The brushes first used on these motors were of copper and a number of forms were experimented on, it being necessary to remove the motor with the brushes completely, which was a serious drawback. None of the experiments with copper brushes were successful, and it was not until the introduction of the carbon brush by the Thomson-Houston Company that the commutator difficulties were largely obviated.

Soon after the Sprague Company entered the railway field, the Thomson-Houston and Westinghouse companies took up electric railway work, and greatly aided its development by adding their immense resources to the resources of the Sprague. The development of street railway apparatus was rapid. The first motors of all the companies used double reduction gearing, and one of the first improvements, after the introduction of the carbon brush, was the design of a comparatively slow-speed motor which allowed a single reduction gearing to be used. The first motor of this kind was made by the Wenstrom Company, and within a short time other manufacturers were making slow-speed motors—some going so far as to attempt gearless motors; the latter, however, were not successful owing to their great weight and lack of efficiency at reasonable speed. Most of the slow-speed motors that were made at this time were not thoroughly enclosed, their efficiency being such that in the ventilation than could be obtained by a totally enclosed machine was necessary. The machines were, as a rule, of the four-pole type, with parallel armature windings, requiring four brushes and causing, under certain conditions, unbalancing in the circuits which greatly increased the armature losses and decreased the efficiency. The next step in motor development was made by the Westinghouse Company in what they called their No. 3 motors, a machine much like those at present in use. It had four poles, each of them provided with a field coil, while the armature was provided with what is called a series winding, necessitating only two brushes and doing away with the unbalanced armature circuits of the earlier machines. This type, with the modifications suggested by experience, is the one used in this country at the present time, and almost universally used abroad.

Controllers.—The first method used for regulating railway motors was by inserting resistance in the circuit of the machine; this was modified and developed until, in the Richmond motors of the Sprague Company, the series-parallel system was used, combined with a variable resistance obtained by the use of various combinations of the coils into which the field windings of the machine were divided. On starting and for slow speeds the two motors were used in series, while for the higher speeds they were placed in parallel. This system was abandoned, and for some years a parallel system for operating two motors on a street car was used. One difficulty found in the early series-parallel control was the liability of the motors to slip when in series position. The slipping on one pair of wheels would allow the motor connected to these wheels to revolve at such a high speed that its counter-electromotive force would cut off the power from the other, and the car would won the motor which had the least resistance, which always exists, but which is not of importance on ordinary roads, was further complicated by the electrical difficulties in the controller—the method of control not being as efficient as that used at present. In the Sprague system, there was no resistance outside of the motors, but the motor fields were divided into a number of coils, and the relations of these coils were varied, giving first a high resistance
and a very strong field for a given current, and afterward a comparatively low resistance and a comparatively weak field. The difficulty of this system lay in the fact that all the heating incidental to the heating of the motors on starting was liberated in the field; and, further, the inductance of the fields was greatest at the breaking of the circuit, when all the coils were in series. The Thomson-Houston Company overcame this by placing a variable resistance directly in the motor circuit, the resistance being regulated by a movable contact arm, controlled by the motorman. This gave better results than the Sprague system, but it also lacked efficiency. In 1891 the General Electric Company brought out a series-parallel controller, similar in some respects to the early Sprague control, but differing from it in the fact that the regulating resistances were not obtained by variations of the different motor field windings, but by resistances outside of the motor. This system, with variations due to different conditions of operation, is still used and gives excellent results. Perhaps the most important development in controller work was due to the introduction of the automatic dynamometer card by Prof. Elihu Thomson. This apparatus is so placed as to control the breaking of the circuits, and almost entirely eliminates the destructive effects of sparking, due to the breaking. The method of operation is as follows: At first the two motors are placed in series, the resistance being also in series with them; then the resistance is gradually cut out, until finally the motors are in series across the line with no outside resistance in their circuits. Then the resistance is again cut in and one of the motors is short-circuited; the next operation cuts out the short-circuited motor, the next places it in parallel with the other motor, a large part of the resistance still being in series with them; the rest of the operations consist in cutting out the resistances until finally the motors are in parallel across the line. The shifting of the circuits, due to the various operations necessary for regulation and cross-circuiting, is carefully standardized against the different sections in compartments.

Multiple-unit System of Control.—In urban train service, where a number of cars are operated in one train, with frequent stops, the question of acceleration is of the utmost importance. In order to accelerate quickly, it is necessary to have a large margin of tractive effort on the train—that is, it is necessary to have a large proportion of the total weight of the train on the driving wheels. When the question of displacing steam locomotives for elevated railway service first came up, and was attacked on the basis of using electric locomotives, the advantages of the latter were not apparent. There was, of course, some advantage in the matter of expense, but not enough to justify the expenditure necessary to change from steam to electric service. Mr. Sprague devised a system by which a number of cars on a train could be equipped with electric motors and controlled from any one of them; this also he called the *multiple-unit* system. At first it was opposed by most of the manufacturing companies and by many electrical engineers. With his customary energy, however, Mr. Sprague worked his system into practical form, and to-day all trains operated by electricity employ his fundamental methods. The advanced system are these: It gives a large portion of the total weight of the train on wheels, and at the same time distributes the weight of the motors over the whole length of the train, this in the first place, this allows rapid acceleration without slipping of the wheels, and on the engine, it does not impose an undue load on any elevated structure. It is also true, to change the number of cars in a train without changing the relative power of the driving mechanism of the car. It more utilizes all the train space for the accommodation of the passengers. Its range, compared with a single locomotive, in the fact that it necessitates a greater number of motors, thus adding to the cost of the locomotive, but it greatly reduces the cost of the system of control.

In the Sprague system each car is with a controlling device operated by a motor, the motor being operated through a circuit controlled by the motorman. To a considerable extent automatic, at which the different positions of the controller on the car are regulated by the flow of current into the motors, determined by the motorman. This important feature of the apparatus and its uniformity, and at a rate of greatest simplicity. The General method of control is somewhat different, this each car having a master-control, much like the ordinary tramway controller, the speed at which the current is through the motors being determined by the rate at which the motorman turns the handle of the controller. In the Westinghouse control paratus which supplies current to a number of cars, the pneumatic system being worked by a local circuit, which has as a source of pneumatic power and accelerated by a master-controller on the train. This makes the operation of the line current and gives very fine action against the different sections in compartments.

Overhead Trolley System.—For the operation of electric cars, a number of devices were used, until finally Sprague at Richmond fixed a type of controller that he afterward introduced to the country and is largely used abroad. Usually determined by experiments, it is possible that a moving contact device is necessary to supply current to the cars without such a device and heating that it would be impossible. The first experiments on electric railway current was collected from the rails; it was collected through small carriages on the overhead wire, and finally it drove into a rotating wheel having a single spring about it. This is the *trolley wheel*. It is called a *trolley wheel*. It is usually called a *trolley*. It is a wire bent into the shape of a circle and against the underside of the trolley wheel. This is the usual arrangement. This is a considerable extent abroad and gives over the trolley wheel country. A number of modifications of these systems have been devised, and the overhead trolley wires, from which...
current is collected, are usually of copper; they are either suspended from insulators fastened to a span wire between poles on the two sides of the track, or from brackets fastened to a pole and projecting over the track. In this country they are almost universally placed over the centre of the track, but abroad they are sometimes placed on the side of the road, the trolley being so constructed as to make a side-bearing contact.

Underground Trolleys.—From the earliest application of electricity to railways, attempts were made to do away with the overhead wires, used in the ordinary trolley systems. Conduits having a slot through which a current-collecting device could pass were placed beside the tracks or between the rails; conductors were placed in these conduits and the collecting devices on the cars were made to bear against the conductors. At first the conduits were not large enough, not enough space was given for insulation, and the results were unsatisfactory. The first successful system to be installed was a tramway at Budapest, designed by the Siemens Company. Here the conduit was on the side of the track, the power plants. The conductor was supported from below by insulators and the system was constructed on a larger scale than had been previously employed—the details were carefully worked out and the road has operated successfully from the time of its installation. In the meantime, in this country, the necessity of some such system in the cities of New York and Washington, where overhead wires were not permitted, had forced the different electrical companies to take up seriously the question of conduit construction, with the result that successful systems were worked out for both Washington and New York, the systems being practically the same. The slot in these systems is in the middle of the track. The conduit is constructed as follows: Cast-iron yokes supporting the tramrail and slot rail are placed at intervals of five feet, the rails are attached to the yokes and the whole structure is blocked up in its proper position; then sheet steel is placed upon the yokes, forming the proper dimensions, and concrete is packed around the yokes and the forms, supporting the structure in its proper position and forming a tunnel for the conductor rails. The steel forms are made of T-iron, held from above by porcelain insulators placed in cast-iron boxes along the track. The details of the different systems that have been installed vary, but the above is practically the standard type of construction.

The current for the car is collected by means of what is known as the plow, which passes through the slot and has two cast-iron contact shoes held against the conductor rail by springs; the rail is supported on cross-arms over the car and has a wide limit of lateral motion. It is usual to place ducts beside the track, these ducts containing the feed wires that are connected at various intervals with the conducting rail.

Generation and Distribution of Current.—In the earlier roads, and, in fact, in many of the roads now operated in this country, the current for the motors is obtained from direct-current machines, having a voltage of between 400 and 500 volts. It is usual, as a rule, compounded so that their voltage increases with an increase of load. There were two reasons for this: One is that the increased voltage compensates to a certain extent for the loss of voltage in the distributing system; the other, and most important reason, is that the strengthening of the field prevents the sparking that might otherwise be caused by the armature reactions. It is the custom to ground the negative side of the machines and connect the trolley wires through what is called a feed wire® to the positive brushes. The feed wire is then carried along the line, connected at intervals to the trolley wires, it being usually the custom to divide the road into sections and feed the different sections from different feed wires. At the voltage which has been adopted as the standard—that is, from 500 to 600 volts—the economical distribution when the service is heavy is limited, and if a direct-current system is to be employed for a large area, a number of stations must be installed. For this reason, when the distances are great, it is sometimes necessary to employ a high potential alternating system, reducing it to a 500-volt continuous-current system at centres of distribution called sub-stations. On interurban lines, where the distances are great compared with the number of units in operation, this method becomes imperative, as otherwise the variations of load on the central station would be excessive, and the cost of power would be practically prohibitive. This method of operation may be described as follows: The central station, located at some point where the greatest economy of operation can be obtained, generates alternating currents at a high potential; these alternating currents are taken to the sub-stations, situated at reasonable distances from one another along the line, and are there changed to alternating currents of lower potential by means of transformers and then converted into direct currents of the proper potential by means of rotary converters. In this way a large area can be supplied from one central station and a comparatively large number of units can be operated at one time from this station, thus reducing the number of sub-stations and the sub-stations themselves, there is, of course, a fluctuating load and it is the custom to install storage batteries in connection with the rotary converters to equalize the load; the battery storing energy when the load is light and giving it out when the load is heavy.

The Return Circuit and Electrolysis.—In most of the overhead traction systems, the current passing through the motors goes through the wheels of the car to the rails, and then returns to the station, *bus bars* finally appearing at the negative brushes of the rails. When a system is operated in this way, the rails are bonded—that is, two adjacent rails are connected by conductors securely attached to the rails and giving a low resistance to the electric current. If the bonding is good, a considerable part of the current passes along the rails while a small portion strays through the earth to other conductors, such as water pipes and gas mains, using these as a return conductor. If the bonding is bad, however, a considerable portion of the return current is carried by the underground pipes, causing them at times serious injury. For this reason and also because of the fact that low conductivity in a rail return causes loss of energy, it is of
importance that the bonding of the rails should be as thoroughly perfected as possible; it should also be carefully inspected at intervals, as the bonds are liable to break and produce a high resistance between the adjoining rails, thus diverting a considerable amount of current to the underground pipes. The matter of the electric traction system has received little attention during the first two or three years of electric railroad development; the effect, however, naturally increased with time and the development of the systems until the serious damage that occurred became evident, and means for preventing it was sought. These means, as a rule, consisted in connecting different points of the rail circuit to the negative bus-bars of the station, by return feeders, and in making metallic contacts between the rail and pipes at points where the current was leaving the pipes; also in metallically connecting the pipes near the station with the negative bus-bars. No electrolytic damages is done when the current leaves the pipe through a metallic conductor; it is only when the current passes from the pipe through an electrolyte, such as is furnished by moist soil, that corrosion takes place. In some places, the joints of the pipes have been insulated to prevent the current from passing through them and this is perhaps the most efficient means of avoiding electrolytic troubles.

Alternating-current Motors.—The most important drawbacks of the induction motor are these: In the first place the motor has practically the same characteristics as a direct-current shunt motor and, therefore, does not afford the variation of speed with load that is one of the most important and valuable features of a series motor. In the second place three circuits are necessary to operate the machine and while the track can be used for one of these circuits, the necessity of two wires over each track, the wires having a considerable difference of potential, makes the practical operation of such a traction system difficult. Numerous systems have been devised for regulating these motors, but they are either complicated or inefficient and it is the opinion of the writer that induction motors will not be used for railroad work except under special conditions. The only advantage such a system offers is that the hand switches that can be and this advantage is neutralized by the fact that the three conductors necessary make high potentials practically unavailable. Electric traction offers a wonderful opportunity for saving in capital expenditure, where expanding demand requires facilities which by other means would be inordinately expensive to provide. The higher sustained speeds of electrically-hauled trains on heavy grades offers an irresistible opportunity to expedite traffic and the flexibility of make-up and movement of municipal and suburban trains is a most valuable consideration. The fact that electricity as a source of railroad motive power offers the only possible connecting link between the waterfall and the locomotive gives it an unique position in the general power distribution field. It is more difficult to prove out the economy of electric operation on this basis, but it is certainly sound over-all conservation to use to the limit a form of motive power that cuts down mate-
1 Caterpillar Tractor for farm work

2 Caterpillar Tractor for army work
Design features introduced to ensure reliability and low maintenance cost include particularly (1) Form-wound armature coils, with special insulation in the ends of the slots; (2) Strap-wound field coils securely fastened and held against vibration; (3) Substantial brush-holder design and construction; (4) Mica insulated, undercut commutations; (5) Bearings of ample size with oil-gauging pockets, lubricated by oil drawn up and filtered through waste; (6) Two-point gear case suspension. The unit switch control has proved itself capable of handling the heavy currents encountered and also to withstand the bumps to which the locomotives are subjected, particularly in switching work, low-speed, drag-freight service or mainline service. In this control the various main circuit connections are made by unit switches, actuated by compressed air taken from the air-brake system; the admission of air to the switch cylinders being controlled by magnet valves, which valves are operated by current from a control circuit through a train line from the master controller. Current from this control circuit is tapped from points on the control resistor which is connected between trolley and ground, or may be supplied by a storage battery.

In late years the solution of the electric railway problems has become more difficult. The automobile has become a most serious competitor; at this time more than 6,000,000 pleasure cars are licensed. The automobile has not only decreased riding upon the trolley cars during business hours, but it has deprived the railway of practically all of its pleasure riding. The entire economic basis of the industry has been undermined and if the business is to survive it must be a radically different business in the future than it is at the present time. It must, in the first place, secure prompt and adequate relief by a sufficient increase in revenues to enable it to function as a public utility; for a rejuvenation of credit is essential to carrying through the radical readjustment in operating methods which will be necessary. In many of the smaller cities, the companies must turn to one-man cars, permitting more frequent service with reduced operating cost. In the larger cities the companies and the public must face the necessity of abandoning the theory of a flat five-cent fare covering the entire city area and of charging the passenger according to the distance which he rides. See American Street Railways; Railways, Street.

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**TRACTION ENGINE**, an engine designed for drawing loads on ordinary roads or across country, and thus distinguished from the locomotive which hauls loads over steel or iron rails. The traction engine is designed to withstand severe jolts and to climb gradients of at least 1 in 10 and on a surface which sinks somewhat beneath the weight of the engine, thus presenting a continual slope upwards in front of the wheels. The speed seldom exceeds eight miles an hour and consequently it is usual to reduce the speed of the driving-wheels from that of the engine shaft by intermediate gearing. Usually attached to the main axle is a winding drum, by which heavy loads may be drawn up bad hills on a wire rope, the engine having previously ascended, light, to the top. A heavy fly-wheel and a high-speed governor are provided. The driving-wheels of a traction engine have tires or treads of great breadth to distribute the weight of the boiler and engine over a large area of yielding roadway. The tires are also usually corrugated or roughened to give adhesion. A very efficient means of steering is always provided in the traction engine to enable it to make the sharp turns required in ordinary roads, and it is furthermore usually so designed that by throwing out the intermediate gearing from connection with the traction-wheels, the steam-engine proper can be used as an agricultural engine for threshing, milling, pumping and other similar purposes. Light traction engines were once
 favorites in drawing plows but have been displaced by the tractor of the internal-combustion engine, although these are really traction engines. It is, however, usual to limit this term to the older type of land engine propelled by steam. This type appears to hold its place in America for hauling threshing machines to the field and for driving them. In roadless countries, such as parts of Australia, Africa, etc., a heavy type of traction engine is employed to haul trains of wagons, as well as to act as portable engines for driving threshing machines, etc. Engines designed for threshing outfits are supplied with fire-boxes capable of burning wood, straw and refuse fuel. Since the opening years of the present century the steam traction engine has been displaced to a very great extent by tractors and engines of the internal-combustion type. (See TRACTOR.) Consult Muggard, James H., 'The Traction Engine: Its Use and Abuse' (3d ed., Philadelphia 1915).

TRACTOR, a machine that draws a load, especially a power-engine mounted on wheels for traveling on roads or rough ground and hauling wagons, trailers, plows or cultivators or the like; a traction-engine. The locomotive (q.v.) was the first common form of tractor, but does not bear the name, and by common consent the term has been confined mainly to road-engines that do not operate on a track or ride on rails. The word tractor began to be used when steam plowing became general. For this purpose a road-engine was developed with massive wheels, having broad metal tires that would not sink readily in soft soil, and to give them greater grip on the ground, or tractor capacity, cross-pieces were fixed on the rims, so as to resist slipping when there was hard pulling. This engine was provided with a long, horizontal boiler, an upright smoke-stack and many of the conveniences of a locomotive. At the rear was usually a draw-bar, to which could be hitched a gang of plows, or cultivators, or mowing or reaping machines. It was mainly used on the Great Northwest, and has been largely introduced in the principal agricultural countries of the world. International plowing matches have been held with these farm tractors, notably at the Canadian government experimental farm in Ontario. These have been instituted by the Ontario Department of Agriculture in co-operation with Plowmen's Associations. But these farm tractors have been too large and costly that their use was prohibited on small farms, and they have been satisfactory only on approximately level areas of ground.

It has remained for Henry Ford and Son to produce a small and inexpensive tractor adapted to the use of the small farm. This machine is known as the Fordson tractor, and as introduced in 1918 carried a 22 horsepower kerosene engine, of the four-cylinder type. The frame is like a small auto-truck, and not much longer than the wheels. It has ball bearings, dust protector, and flanges to prevent side slipping. The rear wheels—42 inches in diameter and 12 inches wide—are the drivers, and carry most of the weight; the gripping flanges of these are of angle-steel, set at an angle of 45 degrees. The driver's seat is between the driving wheels, and the motor control is operated from a light control truck. A bevel-pinion and sector are connected with the steering wheel, and the engine is enclosed and lubricated by oil splash. Dim under this is the throttle lever, the spark is being adjustible. The distance between the wheels, constituting the tread, is 38 inches, and the machine can turn a complete circle within 21 feet. The ordinary plowing speed is two or three-quarters miles an hour, with a load of two and one-half miles an hour, the draw bar pull being 1,800 pounds and 2,500 pounds respectively. When traveling or doing farm work, a speed of six and three-quarters miles an hour is available. Fairly good ground can be plowed at the rate of about three-quarters of an acre an hour, varying, of course, with conditions. A little less than three gallons of kerosene per acre is a fair average consumption. With fuel and water tanks full, the machine weighs 2,700 pounds.

AUTOMOBILE TRACTORS. As soon as modern auto-trucks were perfected and began to have a considerable sale, it became apparent that it was a convenience to separate the tractor from two or more parts, one being a tractor, the others trailers. Many of the manufacturers of auto-trucks build tractors on the same general lines as their trucks, instead of providing them with a rear body carrying a load, there is simply space for attaching a "fifth-wheel" device, or else a draw-bar, which a trailer can be easily attached to. A typical form of these is shown in the illustration, the tractor having four low heavy wheels with radiator, motor and cab in front, and rear of the chassis' clear for supporting a fifth wheel or turntable device, on which the front end of a trailing car may be supported. About 40 per cent of the weight of the trailer is designed to be carried on the tractor, and as the trailer has but two driving wheels, located at the rear, it is provided with the extensive wheel frame, in the front with a pair of light driving wheels, that are swung out of the way when a part is attached to the tractor, which can be used to keep it upright when not connected with the tractor. This type of trailer is of the four-wheeled type, that bears all its own weight, and is pulled by some form of draw-bar.

The combination of auto-tractor and trailer is very convenient, for it not only enables the tractor to do the plowing or other work, but it can be used to haul all sorts of freight cars, and often a number of them in a train.

The method of connecting the tractor to the trailer by a fifth-wheel device is shown in the illustration. Tracks T are mounted on the frame F of the tractor, and a swivel S is between the rails. The fifth-wheel device consists of an axle centrally mounted on the swivel, and two light wheels W. W that are round, of steel construction, and revolve in a half circle. The forward end of the trailing car C is mounted and fixed on this fifth wheel device. The fifth-wheel device of course takes its name from the fifth wheel on the front axle of an ordinary wagon, though
has been developed into a mechanism that is much more than a wheel. Some manufacturers use a swiveling pair of bolsters instead of this fifth-wheel device. When a trailer is loaded ready to start, the tractor is backed up to it and hitched on. In simply guiding the wheels of the fifth-wheel device upon the tracks: or, if an automatic coupler is used, the method of connecting may be very similar to that used in coupling railway cars. It is necessary to provide trailers with brakes, else they might create trouble in going down hill, and these have to be connected with the tractor, so as to be operable in unison with the brakes when set by the driver. The connection between tractor and trailer must also be such as to permit a rocking motion, so that when passing over uneven roads all the wheels shall travel on the road without straining the framework.

Military Tractors.—The military "tank" which attained fame in the World War was based on a peculiar form of tractor designed to work of the naval- and army-engineering operations, canal building, etc. The very heavy endless chains, bearing feet on each link, fitted these machines for the most arduous pulling work under the most trying conditions, and some military man among the British recognized their possibilities when armored, and the military "tank" was the result, introducing this type of machine to untold thousands who otherwise would never have heard of it. Though too slow of operation to compete with the ordinary tractor of auto-truck type, yet the tank-tractor has such superiority in marshy, stony and very rough ground, that it has obtained considerable use.

The Symmotor.—Another peculiar form of tractor that has been invented by a New Jersey genius is called the symmotor. It is an adaptation of the motor-cycle to agricultural traction. Instead of pneumatic tire wheels, this machine is provided with steel rims and angle grips, like the wheels of big farm tractors, and is designed to draw cultivators, seeders and small mechanism used in truck farming. Its peculiarity lies mainly in its being attached by a wire to a central post, around which it circles in revolving spirals. When started on a circle of ground it does its work automatically until the entire circle of 100 or more feet in diameter is plowed or cultivated, excepting a small portion in the centre. It operates in a four- to seven-foot swath, and uses gasoline fuel.

The drawing or pulling device of a rope-way or wireway is also termed a tractor. See Motor Truck; Tank.

TRACTOR, Caterpillar. A tractor employing, instead of the usual drive wheel, a flexible steel belt, or track, which supports the weight of the machine, even in very soft ground and gives it greatly increased tractive efficiency under all conditions. Invented by Benjamin Holt, of Stockton, Cal., about 1900, it was first used in the peaty soil of the San Joaquin delta, or "smile," country. It is particularly adapted to cultivating or other plowed ground, since there is no soil packing; to reclamation work in swampy land; to haulage where roads have not been established, as in desert, forest or in military operations; to climbing grades, since it affords unusual pulling effort in proportion to weight, and to other extreme conditions. It is also used, of course, wherever ordinary tractors can be used and is often preferred because of absence of injury to pavements. "Caterpillar" is a trade-marked word properly applied only to the Holt tractor. Other tractors following the same general principle are referred to as "Crawlers," "Creepers," "Alligators," "Centipedes," "Tracklayers," etc. See Tank.

TRACTOR ENGINE. See Internal Combustion Engine.


TRACY, trâ'si, Benjamin Franklin, American lawyer and politician: b. Oswego, N. Y., 26 April 1830; d. 1915. He was admitted to the bar in 1851, was district attorney of Tioga county in 1853-54, and in 1860-65 organized a republican party in New York State and served in the legislature during 1861-62. At the opening of the Civil War he recruited two volunteer regiments in New York, the 109th and the 137th, and became colonel of the former. Later he was colonel of the 17th regiments of United States negro troops, and at the close of the war was brevetted brigadier-general of volunteers. As United States district attorney for the eastern district of New York, 1866-73, he drafted an internal revenue bill which more than trebled the United States revenue at a time when the huge war debt was being liquidated. In 1881-82 he served as judge of the Court of Appeals, and in 1889 became Secretary of the Navy in President Harrison's Cabinet. His term was marked by a large increase in the navy and the formation of a reserve naval militia. At the close of this service he resumed his law practice in New York. He was president of the commission that drafted the charter for Greater New York in 1895-96, under which he was the Republican candidate for mayor in 1897, but failed of election. In 1899 he was counsel for Venezuela in the boundary arbitration between that country and England.

TRACY, Joseph, American Congregational clergyman: b. Hartford, Vt., 3 Nov. 1794; d. Beverly, Mass., 24 March 1874. He was graduated at Dartmouth in 1814, ordained to the ministry, and was pastor-of churches at West Thetford and West Fairlee in 1821-29. He edited the Chronicle, Windsor, Vt., for five years, the Boston Recorder for one year and then became president of the Massachusetts Colonization Society and of the American Colonization Society for Massachusetts, which positions he held until his death. He was associate editor of the American Historical Review for many years and published 'Three Last Things' (1839); 'The Great Awakening, A History of the Revival of Religion in the Time of Edwards and Whitefield' (1842); and 'A Memorial of the Semi-centennial Anniversary of the American Colonization Society' (1867).

TRADE. See Commerce; Imports and Exports.

TRADE, Board of. (1) In the United States a body of men selected from among the business men, was appointed to represent and act for the whole business community in advancing and protecting their interests. (2) A similar body acting for a trade or industry, usually for the regulation of trade abuses. (3) In England a permanent committee of the Privy Council, presided over by a member of the Cabinet, and divided into seven departments, each having its separate staff. It controls the issuing of patents, registering of joint-stock companies, handles trade insurance, settles disputes, etc. The British Board of Trade conducted highly useful work during the great World War, exchanging commercial intelligence, and assisting manufacturers and merchants in the unusual problems confronting them.

TRADE ASSOCIATIONS, business organizations composed of the individuals, firms and corporations engaged in a trade or industry, formed and operated to deal with those things in which the membership have a community of interest, as wage scales, uniform rules and measures, guarding of legislative interests, maintaining prices, exchanging of information as to credits of customers, etc. These associations in the United States developed mainly after 1870, largely as a result of the growth and activity of the trade unions. (See UNIONISM). The demands by workmen for better pay and conditions were generally resisted, and employers met and began to organize against their employees. Before such meetings the proprietors in a particular trade rarely had any personal acquaintance, knowing each other's business, and usually having a low opinion of each other, because of sharp competition and business rivalry. Brought into contact over labor difficulties, their views as to each other changed; they learned to respect their competitors, and warm friendships sometimes developed between them. They began to talk with each other about trade problems, and soon saw the wisdom of combined action in securing trade reforms. Their anti-union associations took on a broader scope; they engaged cooperatives and good business managers, and began to do business in those things which were for the common interest and benefit of the trade. So came into being the American Newspaper Publishers' Association, the National Association of Stove Manufacturers, the Association of Wool Manufacturers, the Typotheta (q.v.), The National Erectors' Association, the Coal Operators' Association, the Photo-Engravers' Association, National Metal Trades Association, National Founders' Association and hundreds of others. As time went on, each of these associations tended to enlarge its scope and sometimes several organizations were formed in one trade, to care for different branches of the work. For instance, in New York City, the Typotheta, the oldest organization among employing printers, concerns itself largely with exchanging information as to costs, bookkeeping, preserving fair competition, watching the presses, etc. The Printers' League handles all labor difficulties and settles disputes as to shop rules and the like. The Master Printers' Association concerns itself with the well-being of the smaller printing offices, the job printers, insists on uniform treatment by paper jobbers, the charging of a fair profit on engraving, binding, etc., reports on customs, pay, etc. In most cities, however, one local organization serves a trade wholly, and no need is felt for two or three to look after various branches of work. It is practically true that in every large city there is a trade organization in every trade represented by a considerable number of houses. These conditions have naturally led to combinations to keep up prices, and the public has been jealous at times of certain organizations, which they classed as a trust in certain trades and industries. At times the suspicion of taking unfair advantage of the public was well founded, and at other times the members of a trade association have only sought fair protection from competition that was ruinous and not advantageous to the community. Where the trade organizations have gone too far, and used their power of co-operation to push prices above a fair level, there has usually been a reaction; either district attorneys have brought criminal prosecutions for combination in restraint of trade, and caused the dissolving of trade associations, or else the increased prices have brought new firms into the field, that did not belong to the association, and these have undersold, and brought down the level of prices to a basis of keen competition. Of late years there is a tendency in the United States for the large trade organizations to work together for business reforms. They call upon each other for assistance in securing needed legislation, and they have formed a National Association of Manufacturers, whose influence is very powerful. See TRADE, BOARD OF; CHAMBERS OF COMMERCE.

TRADE DOLLAR, a former coin of the United States, containing 378 troy grains of silver and 42 troy grains of alloy. Trade dollars, issued under Act of Congress 12 Feb. 1873, were legal tender to the amount of $5. Those issued under the Act 22 July 1876 possessed no legal tender power. They were intended for trade with countries doing business on a silver basis. As silver depreciated in value the trade dollar depreciated, and speculators bought them abroad at 80 or 90 cents and circulated them in the United States at face value. This was easy because specie payment had just been resumed by the government in 1875, and people liked the silver. When the lower value was generally understood, and they continued to fall in price, they were objected to and gradually disappeared from circulation.

TRADE-MARKS. Certain marks or inscriptions set on manufactured goods for the purpose of establishing the identity of their manufacture or selection. An examination of the evolution and development of the trademark in the United States of America is substantially an examination of the evolution and development of the vast commerce of our country.

Definition.—A trade-mark is a mark or sign indicating the source or origin of the article to which it is affixed. Unlike a patent (q.v.) it is agreement evidence it evidences competition, and lays claim to a degree of superiority in such competition. A trade-mark may consist of a word or words, or of a symbol, design, device or picture; or
it may be constituted by an original and distinctive shape or form of package in which the goods are packed or contained; or it may consist of a combination of some or all of these elements; but in whatever form the trade-mark appears on the market, its office is either to indicate the origin or ensure the manufacture of the article, or when used, as it may be, by the dealer who sells to the ultimate purchaser or consumer, but who does not manufacture or produce the article, it may then indicate selection or endorsement of the manufacture of the article bearing such dealer's mark.

Office of the Trade-mark.—Not only does the trade-mark indicate the source or origin of the goods to which it is attached, but it also performs the office of guaranteeing or assuring to the purchaser, whether he be an intermediate or an ultimate one, that the honest skill of the owner of the trade-mark, the good quality of the goods, the carefulness of selection, the purity of ingredients or correct and fanciful design or measure are to be found in the articles to which such mark is affixed. Further than this the protected and defended trade-mark builds up for the manufacturer to whom it belongs that following in the market which becomes intensely valuable in appraising the goodwill of such a business.

The Origin of the Trade-mark.—The introduction of the trade-mark into commercial use was natural, and when once effected rapidly became a trade necessity. A chemist in the olden days prepared a mixture or lotion and recommended it to the customers of his shop, who found it efficacious. A shoemaker made shoes for his patrons which by reason of good quality and superior workmanship won favor for him among his patrons; so that these trades-people, pursuing their various lines of industry, not only retained their custom, but were recommended by their patrons to others, such customers becoming accustomed to resort to the shop of the one or the other of these trade-marks who supplanted such wants, a habit which is known in law as the goodwill of a business.

So long as the customer of the chemist transacted his business face to face with him in the same old shop or store, neither the shoemaker measured his patrons and delivered his goods to them in person, so long was it unnecessary for such manufacturers to mark their wares.

Their customers and patrons obtained a personal delivery and needed no other assurance or guaranty as to the genuineness of the articles purchased by them; but after a while, some of these purchasers and users of these various articles removed to other localities, and would desire to continue to use the same lotion or wear the same shoes; and they would order the same directly, if they could; or through some agent middleman if they could not; and then in the latter case, to quiet any apprehension which such customers residing at a distance might feel regarding the genuineness of the articles delivered to them, the chemist would affix a label to the bottle or jar containing the lotion, which would bear his name and address; and the shoemaker would mark on some part of the shoe his name and address; after a while the producers of these various articles found that the mere use of their name and address, while constituting a good and sufficient indication of the origin of their products, was nevertheless subject to several matters of inconvenience; the first was that perchance many of the customers could not read; and the next was, that the use of the name of the manufacturer alone was attended by a legal difficulty, to wit, that while a man's name would constitute a most perfect trade-mark, yet any other man bearing the same name had an equal right to use it, provided he did so honestly and fairly, and if engaged in the same line of business, a trade confusion would naturally and often did arise, as witness the Brown Iron Bittes case.

Adoption of Symbols and Arbitrary Words.—To reach and remedy these difficulties, manufacturers then began to adopt and use symbols consisting of pictures or devices, at first simple in their nature, such as shields, stars, geometrical figures or representations of animals and the like; they also coined arbitrary words and fanciful marks or devices of origin, which were generally used in connection with the name and address of the manufacturer; and so it came to pass that symbols, devices and arbitrary designations or titles were slowly, gradually, but generally substituted in the place of the mere name and address of the manufacturer; the goods in due course of time became known by such marking; the marks, in turn, served to indicate origin, as well as to guarantee the peculiar excellence which the purchasers or consumers expected and had a right to find in their purchases with respect to quality, purity, measure or value.

So public usage has also often given an accidental meaning to a trade-mark, not at all contemplated originally; as witness the case in France, where a man named Jean Bardon manufactured cigarette paper, marking it with his initials, "J. B.," which he separated by a lozenge, so that the mark appeared to be the word "JOB." The public became accustomed to call for "JOB" paper, and that name was duly protected as a trade-mark, although it had never been intended to invent or use the word "JOB" in connection with Jean Bardon cigarette paper.

Requirements of a Valid Trade-mark.—Inasmuch as the chemist, the shoemaker, the grocer in "markets over" or "open markets," it so soon became evident that, in order to secure a trade-mark which would be unique, and the exclusive property of the person or firm originating and adopting it, such mark would of necessity have to be one which others did not have an equal right in law to use for the same class of merchandise; so that it became an established rule of construction of the law of trade-marks that no mark would be protected as the exclusive property of any one person which others had an equal right to use; as, for instance, a mark indicating quality, or a geographical mark, indicating that the goods bearing the mark were made or produced in a certain locality; or a mark which merely consisted of the statement of ingredients, or the generic or class title of the article; to be perfectly plain, every person living in New York, making hats or shoes, or other articles of commerce, would have the right to label and the right to use the word "New York Hats" or "New York Shoes" or the like; so every person would have the right to make
the "Best Quality Hats" or the "Best Quality Shoes" or "Superior Hats" or "Superior Shoes" or the like.

Kinds of Trade-marks.—There are two distinct kinds of trade-marks, to wit, a mark consisting of a word or words, or a mark consisting of a symbol or picture.

The former kind may be designated as an "ear-mark," and being mainly distinguished, when legally fixed, it has been held by high authority that the use by another of a similar word, alone or in any form or combination, or in connection with any style of label or form of package, is unlawful, and would constitute an infringement upon the original mark.

The other kind of a mark, consisting of a symbol or picture, may be designated as an "eye-mark," because it appeals to the sense of sight. To constitute an infringement upon such a mark, the defendant's mark must be of so close a resemblance as to be likely to mislead a purchaser using ordinary attention. There may be also an infringement upon important parts of a trade-mark, without the whole of the mark having been infringed. This will be the case, because the law does not look for complete identity in the imitation trade-marks, but similarity will be held sufficient to warrant the interposition of a court of equity.

Secondary Meaning? Phrases Protected.—In dismissing this branch of the subject, it may be stated that no mark which merely indicates an essential element or quality of the article to which it is applied can be exclusively appropriated as a trade-mark, subject, however, to one important qualification which has attended the evolution of the law of protecting industrial property in this country, and which was rendered necessary by the natural and proper desire on the part of our courts and judges to do equity and to protect the purchasing public.

The exception to which we refer is when a term, phrase, title or designation which is used in connection with a trade-mark acquires what is known as a "secondary meaning" in the market. By this we mean that when a phrase, title or designation, which of itself could not be protected as a technical trade-mark, because primarily conceived and designed to merely invite trade or catch and engage public attention, becomes in time so identified and associated with the articles of merchandise to which it is affixed, that the public, on seeing it, at once recognizes that it stands for the goods to which the trade-mark proper is usually attached, even though that mark should be absent.

An illustration of this may be found in the case of a trade-mark for a certain medicine; the words "Candy Cathartic" are certainly descriptive, as fully descriptive as any words well can be; but they had been used to so large an extent and were so thoroughly advertised in connection with the medicine, in question that it was shown that many purchasers instead of calling for the trade-marked name of the article would ask for "Candy Cathartic," any druggist handling the article so associated and identified the secondary phrase or title, "Candy Cathartic," with the trade-mark proper that when "Candy Cathartic" was called for a box of the tablets would be promptly handed out. The court accordingly protected such descriptive phrase by use by a competing firm.

"Camel's Hair," a purely descriptive term for belt ing, was protected after it had acquired a secondary meaning on the market, as applying to a particular make of belt ing. Likewise, "Stone" was upheld as a designation for ale, the name Stone being the name of the village in which the brewery was located, and which through such use had come to designate a particular product.

Likewise, a geographical name may acquire a secondary meaning, especially against infringers who do not reside in the same geographical territory or locality; as witness the fact that "Saint Louis" was protected as a mark for lager beer against brewers using the same title, but not doing business in the city of Saint Louis. The history of the "Durham" tobacco case may also be profitably considered, where Blackwell, the proprietor of "Durham" smoking tobacco, failed in his attempt to restrain another tobacco manufacturer of Durham from using such title in connection with tobacco, whereas certain Virginia tobacco manufacturers outside of Durham, becoming emboldened by the defeat of the Blackwell concern, began to use the title "Durham" in connection with their tobacco, but were promptly enjoined from so doing by the court.

By it no means follows, however, that the defense of such trade-marks by the courts establishes the wisdom of their selection as such marks. On the contrary, they are to be avoided as leading to litigation more or less annoying and expensive. In the selection of a trade-mark every precaution should be taken against personal, geographic and descriptive names, and equally against such marks as in appearance or in sound as spoken shall simulate trade-marks already owned by others. An error in these respects, even though it escapes legal prosecution, may result in the partial or total waste of money spent in advertising, which, indeed, may redound as well to the advantage of a competitor as to one's own. Another point to be remembered in devising or selecting a trade-mark is that it should be simple and easily recognized. Few customers give keen and close observation to goods purchased, and the ultimate value of the goodwill of a manufacturing business may be largely dependent upon the instant and unqualified recognition of favorite brands.

The Doctrine of "Clean Hands."—Another and most important must be considered by the owner of trade-marks is in their correct use of their trade-mark.

The usual protection and relief sought against infringement and the invasion of trade-mark property is by means of a suit in equity brought to restrain the infringer from continuing to imitate or use the infringing mark, and for an accounting for damages; but as such a proceeding in equity is governed by well-settled principles of equity, one defense which has been frequently urged and successfully raised to defeat any action on the part of the owner of a trade-mark is what is known as the defense of "unclean hands."

It is a well-settled principle of equity that
TRADE-MARKS

he enters a court of equity, seeking equity, do equity, and come with clean hands.®
other words, a party will not be heard
mplain of the wrongful acts of another
against himself, if that same party has
guilty of similar wrongful acts of fraud,
presentation or deceit against the pur-
ging public.
the United States Supreme Court in the
ated and leading case of Manhattan
Company against Wood, many
ago, laid down the doctrine that a party
find no relief in a court of equity as
it an alleged wrongdoer if he himself
guilty of wrongdoing in using the mark
eive the purchasing public.
ving this important fact in mind, it be-
s trademarke owners and users to be very
il in the use of their marks, labels and
ages, and the following simple rules may
be observed for their protection and benefit.
statement of the mark, its origin or
quantity of the articles to which the
is attached should be used in connection
he labels, packages or accessories of the
. So, also, if a trade-mark was not orig-
adopted by a party but was acquired by
er or assignment, such fact must be dis-
ounced on the labels or packages. The
, however, will not countenance the trans-
assignment of a trade-mark except as
of the transfer of the business which it
presented. The business cannot be trans-
to one party and the trade-mark to an-
tile the doctrine of "Unclean Hands" has
 carried to a very great extent by the
, it has been held in many cases that the
an application of such a rule would lead
destruction of valuable industrial prop-
nd, at the same time, relegate the purchas-
blic to the tender mercies of false, fraud-
and infringing marks.
trale courts have in many cases recog-
ct that where there is no vicious or
ful intent on the part of a trade-mark
, who is shown to conduct a legitimate
est business, that slight lapses or im-
al conduct do not put such an assignee
and statements which are substantially
although not entirely so, will be over-
and not visited with the punishment of
g equitable relief to the trade-mark
which is guilty of such infractions.
understanding which the public has of
trade customs or usages are also al-
to prevail; as witness the "Hennessy
® cases, decided by the New York courts
ells, where the defense was interposed
e misstatement of fact, of the absence of
r quarts in size, and that, therefore, the
of said trade-mark were guilty of in-
and misconduct; but the court held that
ach as such pints or quarts were known as
erl® pints or quarts, and understood
by the purchasing public, that no fraud
her contemplated or had been committed,
ough the bottles to which the mark was
d were not of full measure.
 TRADE-MARK Property is Acquired.
by a party by priority of acqui-
and continued use on the market.
e announcement of an intention to adopt
a certain title or symbol which is not followed
or accompanied by use on the market does not
confer any trade-mark rights. Moreover, the
law requires that the trade-mark shall be in
actual use in trade before application is ma-
ple for its registry. There is no mark may be
lost to by deliberate abandonment or the transfer
to others of the title or goodwill of a business
in which the mark has been used.
The person who adopts and first uses a
certain distinguishing mark for his goods, be-
comes possessed with what is known as the
common-law right of ownership thereof, and
such right is an enforceable one, and will be
protected by the courts of this country.
Patent Office Registration.—Trade-marks
may be registered under the existing registra-
tion statutes only when the same are used in
commerce with foreign nations, or among the
several States or with Indian tribes. The
provision for marks used among the several
States is new and in force since 1 April 1905.
Under this law marks exclusively used for 10
years preceding the passage of the law can be
registered, irrespective of the prohibitions in
the law, which would otherwise apply. Regis-
tration confers no greater property rights than
are acquired under the common-law right of
ownership, except that triple damages may be
recovered in certain cases. Registration, how-
ever, does not create a right to a trade-mark;
this is gained only by priority of adoption. The
trade-mark thus signifies a public claim to such
adoption and use; if it is not in accordance
with the facts the registration may be canceled.
Before registry a trade-mark is published 30
days in the Official Gazette of the Patent Office,
during which period any person having good
grounds for believing that its registration
threatens his rights may oppose its registration.
Besides the national law in the matter most
of the States have trade-mark laws which pro-
tect the infrastate use of a trade-mark, a use
which is not covered by the Federal law.
Assignment of Trade-marks.—Trade-
marks may be assigned with the goodwill of
the business in which they are used, or a trans-
fer of the business itself; or they may descend
by inheritance; but such an assignment
recorded in the United States Patent Office
within three months of its date or the good-
will thereof does not vest in the assignee any
enforceable right or title. A trade-mark has
no value or standing apart from the goodwill
of the business of which it has been a part.
Partnership Marks.—Upon the dissolution
of a partnership, either partner may there-
after continue to use the trade-marks of the
partnership, unless the same are otherwise dis-
pensed of upon the dissolution, or where other
contractual relations exist governing the future
disposition of the same upon a dissolution.
Defenses.—In cases of infringement, actual
defense by the infringer need not be proven.
The likelihood of deception is sufficient to war-
rant the interposition of a court of equity.
It is no defense that the infringing article is
superior in quality to the genuine, nor is the
absence of intent to deceive a defense. Laches
or delay in asserting rights are generally held
to deprive the owner of the right to claim dam-
ages or obtain a preliminary injunction. Aban-
donment is also a good defense, but strict proo
of an intention to abandon ownership is essential to the establishment of this latter defense.

Patented Articles.—Where a new trade-mark consisting of a word-symbol is affixed to a patented article, the right to use such name or title for such article will become public property upon the expiration of the letters patent, as was held in the "Castoria" and "Singer Sewing Machine" cases. Otherwise the monopoly enjoyed by the owner of a trade-mark is perpetual.

State Laws.—In many of the States, acts have been passed making it a criminal offense to refil or use again without the owner's consent bottles or other packages which have been registered under what are known as "Bottling Acts" or Trade-mark Registry Acts; so in many of the States the imitating or counterfeiting of trade-marks is made a criminal offense.

Labor Union Marks.—In many of the States labor unions or associations of working men are permitted to register their labels or device marks to which such labels or marks are affixed, as a trade-mark; and such marks have been sustained as constitutional in most of the States.

Copyrighting of Labels.—New labels, not previously used, and containing some artistic or novel character of design, may be copyrighted in the United States Patent Office and will be protected for 30 years. But labels which merely describe an article, or only indicate size, number or weight, or are only the result of the application of the typesetter's art, are refused copyright entry.

Unfair Trade Competition.—An article on the subject of trade-marks and their protection in this country would at the present time be incomplete without some mention of the cognate subject of "Unfair Trade Competition."

The evolution of the law of trade-marks in course of time satisfied the courts of this country that the mere enforcement of strictly technical trade-mark rights fell far short of the practical requirements and necessities of our commerce, inasmuch as the purchasing public was being constantly cheated and defrauded in having goods not of a genuine source of origin presented to them under the name of such genuine goods, as well as the purchasing public, were frequently left without redress or legal protection. To remedy this defect of the administration of justice, the restraining of unfair trade competition was applied to cases where technical trade-mark rights could not be enforced.

The essential difference between a case brought to restrain the infringement of a technical trade-mark, and to restrain a case of unfair trade competition, may be summarized as follows:

Both suits are brought to restrain a fraudulent act of the defendant; both proceed on the theory that a court of equity will protect the property rights of the owner of the trade-mark, and, at the same time, guard the purchasing public against being deceived; but while in a case brought to restrain the infringement of a trade-mark, no proof of actual deception is now required, nor is any proof of damage to the owner; in the suit brought to restrain unfair trade competition the essence of maintaining suit is in the establishing of the fraud committed by the defendant and the actual deception caused thereby upon the purchaser. Probable deception is ranked with actual deception in constituting infringement. It is strung as an acronym to steal the great established business.

It thus follows that in the external principles of doing equity and giving fullest protection to the purchaser, man may even be restrained from using his own name in the transaction of his business where such use is of a fraudulent character calculated to breed trade confusion and to mislead and deceive the purchaser already accustomed to that name as with another line of merchandise.

History.—Trade-marks are of antiquity, being found on bricks unea among Egyptian and Assyrians and upon Egyptian pottery dating back to 6000 B.C. Such goods were on gold and silver ornaments and engraved jewels, and the containers used by Roman pharmacists for their salves, sanitations. In more recent times the laws protecting workers in metal and armors in such trade-marks as 1374. In the Middle Ages guilds in Germany, France and Italy compelled use of trade-marks by their members as a protection to the purchaser as well as to the trade, general. Trade-mark protection in England did not begin until 1783, and it was not until 1787 that laws were passed which afforded adequate protection. In the United States for a trade-mark law began in 1790 and the Federal trade-mark law was not among the statutes until 1870. The present bears date of 1905.

Trade-mark law in the United States has substantially been made during the last two decades; for the first reported American mark case found in the books is in against Locke, decided by Chancellor Coxe in the Court of Chancery in the State of New York in January 1840. The following years have seen sporadic and individual American trade-mark cases until the owners of such trade-marks, as well as the purchasing public, have frequently been left without redress or legal protection. To remedy this defect of the administration of justice, the restraining of unfair trade competition was applied to cases where technical trade-mark rights could not be enforced.

The essential difference between a case brought to restrain the infringement of a technical trade-mark, and to restrain a case of unfair trade competition, may be summarized as follows:

Both suits are brought to restrain a fraudulent act of the defendant; both proceed on the theory that a court of equity will protect the property rights of the owner of the trade-mark, and, at the same time, guard the purchasing public against being deceived; but while in a case brought to restrain the infringement of a trade-mark, no proof of actual deception is now required, nor is any proof of damage to the owner; in the suit brought to restrain unfair trade competition the essence of maintaining suit is in the establishing of the fraud committed by the defendant and the actual deception caused thereby upon the purchaser. Probable deception is ranked with actual deception in constituting infringement. It is strung as an acronym to steal the great established business.

It thus follows that in the external principles of doing equity and giving fullest protection to the purchaser, man may even be restrained from using his own name in the transaction of his business where such use is of a fraudulent character calculated to breed trade confusion and to mislead and deceive the purchaser already accustomed to that name as with another line of merchandise.

History.—Trade-marks are of antiquity, being found on bricks unea among Egyptian and Assyrians and upon Egyptian pottery dating back to 6000 B.C. Such goods were on gold and silver ornaments and engraved jewels, and the containers used by Roman pharmacists for their salves, sanitations. In more recent times the laws protecting workers in metal and armors in such trade-marks as 1374. In the Middle Ages guilds in Germany, France and Italy compelled use of trade-marks by their members as a protection to the purchaser as well as to the trade, general. Trade-mark protection in England did not begin until 1783, and it was not until 1787 that laws were passed which afforded adequate protection. In the United States for a trade-mark law began in 1790 and the Federal trade-mark law was not among the statutes until 1870. The present bears date of 1905.

Trade-mark law in the United States has substantially been made during the last two decades; for the first reported American mark case found in the books is in against Locke, decided by Chancellor Coxe in the Court of Chancery in the State of New York in January 1840. The following years have seen sporadic and individual American trade-mark cases until the owners of such trade-marks, as well as the purchasing public, have frequently been left without redress or legal protection. To remedy this defect of the administration of justice, the restraining of unfair trade competition was applied to cases where technical trade-mark rights could not be enforced.

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The Philosophy of the Law of Trade-marks.—The whole legal and underlying principle of the law embraced in this subject is the idea that the entire philosophy of our law is founded upon the theory of securing honest trade and fair competition in the commerce of our national market. The doing of strict justice between man, while protecting the property rights which are at the present time found to exist in the transaction of business, both in the ability to enjoy and secure from invasion the marks or descriptions of the goods, is the effort to retain the good will, which are used, even if one has or can have the right to sell as ostensibly the product of another, and to build up a good will by pronounced of his products.

Equity has been poetically termed "flower of justice"; and equity, with its rules, and with the acute conscience
t, is able to prevent and remedy acts of
vice, where the law itself would other-
prove powerless and futile. See Patents.
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RADE AND TECHNICAL PRESS,
rican. The principal function of the trade
tical press publication is the advancement of
ommercial, industrial, professional, scien-
or other interest, which they represent, by
ing the reader informed as to the prevail-
itions of his trade throughout the trade
and even the entire world. Thus a
edited, broad-minded, accurate and pro-ive trade journal will exert a great influ-
ward welding together the separate
 of each great profession, trade or in-
y into one vast community of interest.
ral newspaper and the trade journal
 the fact that the former appeals to
whole public, whereas the latter caters to a
er class of professional, commercial, tech-
or scientific readers, giving within its
as only such knowledge as pertains to its
al field.
ese organs, of which every great trade
country has its own, bring to the atten-
of those interested any invention or dis-
y which is, or in time may become, of
t importance, but which to the general
c would be of little or no interest; they
ent the conditions of the home and foreign
ets by giving tables of quotations others
accessible to the trade; and gather re-
able information which may be a guide to,
how any light upon, future conditions.
ved processes or methods of manufac-
and changes or improvements in other
ries which would possibly have a bear-
 upon a certain trade; the many items of
ral interest to the lines with which they
erned, and the public questions which
ly affect those interests; the almost in-
 changes taking place in the industrial
d; all these, and more, are chronicled in
issue of the trade journal and discussed
knowledge of detail, a grasp of the sub-
 and fullness of treatment to be found no-
e else.
uch papers are of much importance to the
 they represent. Some are merely ad-
ing sheets; some contain literary matter
 with the special news; others are deeply
ic; yet each is conducted to subserv
interest of the respective trade. Of these
 are some are published weekly; some semi-
ly and others monthly; and a number of
ancial papers, which may be considered as

belonging to this class, are published daily.
Some instances among trade journals have en-
joyed remarkable and continued success, and
have financially prospered far more than had
been hoped, but the history of journalism is
strewed with the wrecks of others whose exist-
ence was of such short duration that they did
not pay for the original investment.
That the trade and technical journal may
have the highest standard of editorial service
and supervision, it is necessary that experts
should be employed in the writing of articles,
and none but the ablest men in each separate
line should contribute, for the reader is gen-
erally an expert in the topic of which they
are employed. The trade and technical journal
is the repository of the information and news
of the field, and it is the duty of the editor to
procure and edit them, and to present them
with a vividness and freshness that is not
 tolerated in the ordinary journal.

The trade journal also occupies an important
position in the field of advertising, for the
judicious advertiser selects the publication which
is read by the class to which his merchandise
will appeal, and this method is more economical
and profitable to him than employing the ordi-
nary newspapers which reach the general public
and are not carefully consulted for technical
matter. The vast number of advertisements
which they publish in every issue, and the prices
which they receive per line for such advertise-
ments are astounding when the competition that
exists for all these is considered. That it is
profitable, however, to the advertiser, is plainly
apparent from the enormous amount of adver-
sising which each journal carries.

The American Railway Journal, of New
York, first published in 1830, was the first
paper which met the desires of one class of
merchants. This was the pioneer of
the specialty commercial journals, and it was
for some time the only one of its kind, for
though a few others had attempted to enter
the field, their stay had been of short dura-
tion, and it was not until 1846 that one which
still exists, was founded. This was the Dry
Goods Economist, but though it began in the
largest trade, it experienced much difficulty in
attracting attention among either the buyers
or sellers, and as conditions at that time were
unfavorable to a journal of this character, it
was not for a long time and only after a bitter
struggle that it rested on firm ground.

These journals were soon afterward fol-
lowed by those in the hardware and leather
trades, known as the Shoe and Leather Re-
porter and The Iron Age, both of which ex-
perienced the same difficulties in gaining a foot-
hold in the commercial world.

Meanwhile, the scientific field had been more
successful as to the number of papers and
periodicals published. The American Journal of
Science was founded in New Haven, Conn.
TRADE SCHOOLS

in 1818, by Professor Silliman, and the Journal of the Franklin Institute, in Philadelphia, in 1825. About 1820 a law periodical was founded in New York, but legal journals did not become common until nearly 50 years later. Medical journals are not always up to date, but some are regularly published in Boston and Philadelphia, and are now to be found everywhere; a little later a journal was established treating of the drug trade. The Scientific American was founded in 1845 and since then many scientific or semi-scientific journals have been started, some of which have touched upon scientific subjects, have been started. By 1860 there were about 20 trade papers and 50 other technical papers; by 1872 this number had increased to 124 trade and 132 other technical papers, reporting 41 different lines, in which religious, agricultural, educational and sporting journals were not included. See Advertising; American Publishing; American Newspapers; American Printing Trade; Newspapers; Periodicals; Journalism; Printing; Printing Presses; Books; etc.

TRADE SCHOOLS. The differences in meaning between such words as vocational, industrial, manual training, technical, trade, part-time, co-operative, continuation, apprenticeship and similar forms of occupational training such as industrial, agricultural, commercial and household arts. A vocational school has for its controlling purpose the fitting of students for useful occupations. The pupil must have reached the age when work can be secured and the courses are below college grade. The aim of such a school is to supplement general education and not to take the place of it.

Industrial education is used in a broader way as in a restricted sense. The term covers all education connected with the industries such as the industrial and household arts of the elementary and secondary schools, technical and trade instruction for industrial workers and training in engineering schools. The term Industrial school is used at times in America to indicate instruction of a primary order which gives pupils one or more branches of industry in order that habits of work and thrift shall be inculcated. This form of school is often used for reclaiming young offenders from evil habits, or for dependent and neglected children.

A manual training school offers activities of a more or less trade-like character with the idea of developing or educating the individual, that hand and mind may be trained together and each help the other. The aim is not to give a wage-earning vocation. The general education in these schools has usually little relation to the trades and is carried further than that imparted in the elementary schools. Such schools are often a feature of the larger city schools. In some of the schools vocational elements are being introduced.

A technical school may be elementary in character or it may train engineers. The aim in both cases is to give theoretical and scientific knowledge connected with a chosen occupation. It prepares the overseer or superintendent rather than the apprentice or worker. In a simplest form such use of tools or apparatus is taught as will show the connection of theory with practice. Handwork is given to explain the science rather than to fit a student directly for a trade. The highest development of this type of school is found in the great technical institutions where both the application of art to industry and the most thorough scientific training are pursued. Two institutions of this kind are the institute of Technology and the great German and American textile schools are examples. The night technical classes so numerous in Europe and America are adding trade features in order to be especially useful to workers who are beyond 16 years of age, the aim being to provide instruction directly related to the employment. Many of the courses offered in the Young Men's Christian Associations are examples. In England the polytechnic schools offer training of this kind. The cylinder, in America is rapidly meeting this same need. Industrial and household arts, science, drawing and forms of industrial arithmetic and English are offered to enable ambitious older workers to get ahead in their trade.
TRADE SCHOOLS

courses, general education, science, drawing and design, business arithmetic and English are frequently given. These schools are being organized in many States as laws are enacted making it compulsory for employers to allow workers between 14 and 16 years of age to attend such schools during the day, for five or more hours per week, without loss of wage. Germany has done much to develop the continuation school during the day and at night. Apprenticeship and craft schools have been organized by some of the railroads and great business enterprises for training their own employees. The work is part-time character and the workers are paid their full salaries. The aim is to increase the ability of the worker for his own sake as well as for the corporation.

This article deals with the trade school as it trains apprentices or journeymen, by day, or supplements their work in the regular trade by part-time classes by day or night. It deals with the wage-earner rather than with the overseer, superintendent and director. The textile and engineering schools and institutes of technology belong to the technical rather than the trade-school field and the instruction is usually of college grade. Some of them have special sections for apprentices, however. Many of the agricultural and mechanical colleges in the United States have trade departments but their work does not always lead to a degree. Drexel and Pratt institutes deal with trade courses in addition to their regular technical and normal aims. Regular all-day trade schools and part-time classes are not yet numerous all over the United States, therefore, other institutions are undertaking trade work to meet the demand of communities to help the workers.

Education for trade has for centuries received attention on the continent of Europe. Complete systems of industrial education have been developed in many countries, from the manual training of elementary and secondary education, through the trade and technical schools to higher engineering and scientific institutions. These schools are generally under government support and control. Within the last 50 years they have become increasingly important and are graduating competent workers for both men's and women's employments. The thoroughness of the courses in these continental schools has rightly given them a high reputation. The length of the trade courses abroad is from three to five years, a fact due to some extent to the demand of the trade unions for a long period of apprenticeship. The United States has some trade schools offering a like preparation. Conditions of artisan life with us are so different that the foreign type of trade school does not altogether meet our needs. The aim here has been rather to give the trade work in as short a time as possible, often in only a few months. This course is frequently accomplished by considerable drill in the theory as well as in the practice of the trade. The New York Trade School offers in its day class three to four months preparation in various building trades, a certificate of proficiency being issued on the completion of the work. European schools do not usually give such short courses as these. The Wilmerding School of Industrial Arts, for Building and Architectural Drafting, the Lick School of Mechanical Arts and the Lux School for Girls, all in San Francisco, and the Williamson School of Mechanical Trades in Philadelphia, correspond more nearly to the European model of thorough training for three or four years. In these schools the aim is to teach the trades with the science underlying them, together with thorough academic courses corresponding to our manual training high schools. The Manual Training High School of the United States surpasses anything of the kind abroad and is a distinctly American type. It does not aim, however, to give trade instruction, and hence the Williamson and the three California schools are not strictly manual training schools.

The value of trade schools has been recognized by foreign governments and they not only control, but also support or subsidize them. The war has temporarily interfered with this instruction in the warring countries, but as peace is established the work will continue. The trade schools already organized all over the United States, therefore, other institutions are undertaking trade work to meet the demand of communities to help the workers.

Germany has been foremost in developing trade instruction to supplement shop experience. The poverty of the workers there, as well as here, forces them early into the shops to earn a living. In order to help these workers to obtain better positions and better salaries, special day, evening or Sunday instruction has been arranged in the Continuation Schools (Fortbildungsschulen). Each German state has made a study of the best way to help its different trade workers. These schools have been so satisfactory that they have not only developed all over the empire, but also in other countries. In Germany they are preferred to the all-day trade school. Belgium and France are renowned for their day trade schools; Austria and Hungary have unusually complete systems of trade instruction, and Switzerland also provide carefully for this class of education. For 35 years Russia has had trade schools to train the workmen in various fields. England's well-organized technical instruction includes trade work also.

GERMANY.

The awakening of Germany to the importance of training her wage-earners took place about the time of the Centennial Exhibition in Philadelphia in 1876, which showed Germany's products to be distinctly inferior to those of other continental countries. The French Exposition of 1878 still further manifested the lack of art in Germany's manufactured goods, and a commission was appointed to investigate reasons and to suggest action. The result of the work of this commission is now seen in the systems of trade and technical schools which have been organized, and in the reputation which Germany now has for the application of science to industry. These schools have been great factors in this change. The German section in the Saint Louis Exposition of 1904 gave evidence that not only in the connection of science with, but also in the application of art to industry, that country has pushed to the front and now takes rank with or even
TRADE SCHOOLS

exceeds those nations which have in the past con-
trolled the industrial field. Germany has be-
come thoroughly imbued with the idea that
money devoted to trade instruction is wisely
spent. The study which has given birth to the
subject has shown her the problem in its
complexity and difficulty. The solution has
been varied to suit the needs of different locali-
ties and also of all classes of workers from the
winter-months of small industries to the direct
work of the great industries. A satisfactory interrelation
between workers, employers and schools has
been the aim as well as social efficiency.

These schools have been founded and are
supported in various ways: by the state, by the
municipality, by the commune, by the trade
guilds, by associations of workers and by
private individuals. There is a marked tend-
cy, however, for the governments of the
German states to assume the entire control and
administration. Small tuition fees are fre-
cently charged. In some of the great technical
or technological institutes gratuitous instruction
is offered to apprentices, but a fee is required for
those who wish to study for more advanced
professional training. Even so, however, cover but
a small part of the expenses.

Germany is giving attention to the training of
apprentices for trade in many classes of
institutions. Different sections of the republic
vary in their way of meeting the problems.
The following kinds of institutions are repre-
sentative: Trade Continuation (Fortbildungs-
schulen) and Industrial Continuation Schools
(Gewerbliche Fortbildungschulen); Trade
Schools (Fachschulen); Technical Drawing
Courses; large technical schools, with sections
for apprentices; apprentice workshops (Lehr-
werkstatten).

Of these the Continuation Schools, generally
conducted by trade guilds, are by far the most
popular for training the ordinary wage-earner.
General education is compulsory in Germany up
to the 14th year. After this time a majority
of the children of the laboring class must
begin to work to contribute to the support of
their families. The continuation schools are
formed to aid those of both sexes who are
forced to work, their object being to supplement
the trade in which the worker is daily employed.
In industrial centres the curriculum is con-
nected with the trades of the locality. In other
sections, the character of the instruction may be
general, commercial or even agricultural, as the
need is felt. The courses deal more with the
theoretical part of the work than with the ac-
tual manipulation of tools. The aim is to give
such instruction as the worker cannot well get
in the shops. It correlates with the daily shop
work and thus aids the workers with the great-
est economy, as the students are productively
employed and expensive laboratories and shops
are not necessary.

The beneficial effect of these continuing
schools on the development of industry and on
the condition of the working class has been felt
so keenly that the imperial government has pro-
vided for a fair share of the cost. The earliest study which she has given to the problem
of the nature of their trade. It often happens that these busy
day workers are too tired when night comes to benefit by such instruction, and week
ends.

The continuation schools found in Germany give instruction of a general character: they emphasize drawing, bookkeeping and
branches as are likely to be of value to
engaged in shop or factory work. For
they add embroidery, dressmaking, sewing,
milling, millinery, and accounting....

varia the work of the Industrial Continuation
schools is so specialized for individual trades
groups of trades that are really trade
continuation schools. Dr. Kerschensteiner,
chancellor of Munich, has been a force in
developing continuation and trade schools
Munich and throughout Bavaria. His is
always to make the students understand
materials on which they are working,
develop in them thought and wise action,
and is said that 30 trades are taught in the school
there.

The trade continuation and trade
proper usually differ from the Industrial Continu-
ation school in giving more specialized
instruction. An illustration of this is
work for boys is the Artisan School, etc.,
in Berlin. The aim is to "give to apprentice
and workmen, especially during their 1
hours, a knowledge of drawing and the
sciences and arts which are needed by the
active trades and which serve as the nec-
complement to their shop practice." All or
drawing, mathematics and sciences are spe-
ized in separate courses directly adapted to
the trade. The hours of instruction are
afternoon and evening of week days and
Sunday morning. All-day courses in
also given at this school.

Trade Schools with all-day work in a
trade are numerous, but are not always
attended. Schools of watchmaking, bask
making, cabinetmaking, horseshoeing, toy
and other trades have been opened in the
local needs. The following is a par
of the occupations provided for in the
schools:

Artisan Schools: carriers, bakers, barbers, basketmakers,
smiths, braziers, bookbinders, cabinetmakers,
chimney sweeps, cooks, carpenters, confections,
dressmakers, dyers, embroiderers (and machine), engravers, gardeners, ga
makers, glaziers, goldsmiths, hatters, dressers, handsewers, ironworkers, joiners,
loom weavers, leatherworkers, lock
laundresses, masons, modelers, mechanically
menders, milliners, paperhangers, painters,
togillers, potters, printers, rugmakers,
ners, spinners, stonecutters, stuccoworkers,
strawplaiters, shoemakers, tinsmiths,
truckmakers, woodworkers and carvers,
ners, wickerworkers, watch- and clockmak
wagonmakers, wheelwrights.

Trade work for girls in Germany is
extensively developed as that for boys.
sentiment of the German people, that
place is in the home, has caused these to
include instruction of a more general character.

The beneficial effect of these continuing
schools on the development of industry and on
the condition of the working class has been felt
so keenly that the imperial government has pro-
vided for a fair share of the cost. The earliest study which she has given to the problem
of the nature of their trade. It often happens that these busy
subjects, which prepare for clerkships or secretarial work, training stenographers, typewriters, etc.; (2) the domestic trades such as housekeeping, needlework, sewing, repairing and ironing, and (3) special trades for women, such as dressmaking, millinery, white work, art needlework, designing, bookbinding, composing and photography. In Berlin the nine municipal continuation schools for girls maintained by the city, and the Victoria Continuation School maintained by private funds, are typical schools of this character. They offer day as well as night work. The Women's Work Schools (Frauenarbeitsschulen) found in many cities, notably in Nuremberg, Bavaria and Reutlingen, Wurttemberg, are day trade schools as is also the Potsdam Trade School for Girls.

The Lette Society of Berlin has done much to foster trade instruction for girls. The aim of the society is the improving of the working class by (1) the removal of obstacles and prejudices in the way of female employment; (2) the fostering of commercial and industrial education; (3) the furnishing information for opening new learning and teaching situations and help where existing institutions are inadequate; (4) the establishment of exchanges for the exhibition and sale of women's handwork; (5) the protection of women against harm, morally or otherwise, especially regarding lodging houses. This society has opened a number of different kinds of schools. The trade courses range from four to six months of all-day work.

The Schools and Courses of Industrial Drawing and Art have made their curricula so practical that they adapt themselves directly to the various trades. There are also, in many instances, workshops in connection with these art schools, in order that the student may have practical experience of the value of his designs and plans. The building and textile trades and such art industries as the making of jewelry, metal and wood working, engraving, gold and silversmithing, painting on glass and china, ornamental designing and decorative painting, are especially considered in these schools.

Elaborately developed systems of special Technical Schools provide for all grades of positions in the building and textile trades. They touch to a small degree the problem of training an apprentice. These great day schools have been very successful. Over 50 of them are to be found for the building trades, and Prussia alone has eight for the textile trades.

There are three grades of labor in the building trades: (1) architects; (2) those who execute the architect's plans, and (3) the workmen. The evening continuation school sometimes provides for the lowest grade, and at other times the building trades school offers a special section. The textile trades have also three grades, and weaving workshops are provided for the apprentices, either in all-day work, or in evening and Sunday classes. In some of the textile schools women are admitted, the one at Aix-la-Chapelle offering an elaborate course of textile drawing, the girls being paid wages according to the value of their work. The School of Textile Art in Plauen, Saxony, has also a department for women. Instruction in embroidery and the making of lingerie is given, the aim being to train superintendents of workrooms.

Apprentice Workshops are organized both in connection with public trade schools and as private institutions. They aim at a more comprehensive training than is obtained in the ordinary shop. The Krupp Steel Works at Essen offer a complete course of apprenticeship.

Itinerant Trade Courses are also provided in such industries as weaving, garment cutting, embroidery, machine work, saw plaiting and bookkeeping. These courses have been beneficial in small towns where there are cottage industries.

The effort of organized labor to preserve handwork and the small trades has been of vast service in Germany in the development of trade schools. The various trade guilds have dealt carefully with the subject of apprenticeship and have been uniting in their efforts to have favorable conditions attend such instruction.

BELGIUM.

Education is not compulsory in Belgium, but the schools are well attended. The primary school is followed by an excellent system of trade education for both sexes. In particular the schools are similar to those in the neighboring countries, but they also present characteristic features. For boys the elementary trade schools are followed by superior trade and technical schools, and those again by the great technological institutions.

Trade-instruction is carried on in the industrial schools (écoles industrielles) and in the trade schools (écoles professionnelles). The first gives theoretical instruction in industrial operations with practical courses in design. The second gives trade work combined with theoretical instruction, has all-day sessions, and is the trade school proper, although many of the écoles industrielles have trade sections.

Trade training of an elementary grade is given in the following institutions:—For boys: Industrial schools, trade schools, Saint Luke trade schools, apprentice shops, trade courses. For girls: Trade schools (including trade schools proper, trade and housekeeping schools, housekeeping and trade schools), trade courses, apprentice shops.

The length of the courses in the trade school proper is from three to five years. The trade schools for girls were organized before those for boys. They offer the most advanced form of trade education for girls. The industrial school is the largest and most important class of institution in Belgium for the training of young men. As these latter schools are supplementary to the trade and do not give regular trade instruction, and as their courses are given at hours when workmen can attend, they resemble the continuation schools of Germany. The number of these schools is rapidly increasing.

Trade instruction in Belgium is justly renowned for certain features: (1) The excellent system of economical administration and wise supervision; (2) the thoroughness of its instruction in general education applied to the various trades and also in the teaching of the trades; (3) the importance of art in all of the schools and the practical use made of it in designing in each of the trades; (4) the adaptation of all of the trade work to local needs.

The trade schools are with few exceptions
under government control, although no general law governs their formation. Schools have been established by communes (écoles communales), by private individuals (écoles libres), and by provinces (écoles provincales). Complete liberty of organization is allowed to local authorities or to private individuals, in order that the schools may be adapted to local needs. This freedom has made these schools really local institutions, conforming to no uniform model. A system of subsidizing them has been devised. A certain sum of money is voted annually for this purpose, and placed at the disposal of the minister of industry and labor. When the schools desire a portion of this appropriation they must submit a formal application, accompanied by details of their work which will enable the ministry to judge if the school should receive assistance.

The government exercises regular supervision over schools receiving the subsidy. Each year they must send to the ministry for approval of their accounts, their budgets for the ensuing year, and any changes in their organization or in their programs. The supervision of these schools is most efficient. An inspector general of industrial and trade education is at the head, and under him is an expert corps of inspectors. Inspections are also made by such provincial or communal authorities as aid in the support. Religious bodies, industrial organizations, and private individuals also help these schools. Some of the schools give free instruction, some require an entrance fee, and others charge for tuition. Students who are too poor to pay for instruction or to attend even when it is free are aided in various ways.

The difference between a manual training and a trade course is very marked in Belgium. The trade schools may differ in characteristics, but they all keep strictly in view the fact that they are preparing students to earn a living in some particular branch of industry. Drawing and industrial design are at the base of all instruction for girls as well as for boys, and are taught with reference to their use in particular trades. A practical general education is also considered a necessary part of the instruction in the trade, and usually occupies the first half of the day. Libraries, museums, collections of scientific apparatus for demonstration, public exhibitions, and provision for traveling scholarships are means used to develop the highest efforts of students.

The provision made for teaching girls is very thorough. The Trade Schools proper (écoles professionnelles) have programs in theoretical as well as in practical work. There are at least 50 of them in the kingdom. The aim is to teach such trades as are open to girls, and at the same time to carry forward the regular school education. The trades taught are dressmaking and cutting, waistcoat- and corset-making, fine lingerie, millinery, artificial flower-making, industrial drawing and ornamentation, embroidery, designing for lace and embroidery, and painting on glass, china or silk. Commercial courses are also given. The general course, with emphasis on French, German, and Flemish languages, arithmetic, history, geography, hygiene and domestic economy, writing, drawing, singing and gymnastics. The instruction is excellent and has been especially adapted to the trades and to the needs of women in their households. A high place is given to domestic economy in Belgium. Its full development is in the housekeeping schools (écoles ménagères), but some of it is required in the trade schools also. The trade courses for girls vary in different schools according to the needs. The length of the course is usually three or four years, but five years are sometimes required.

The pioneer trade school for girls in Belgium is the Bishofshem, 94 Rue de Marsa, Brussels, established in 1865. The age of entrance is 12 years, and the length of the course is four years. The trade courses are numerous and well taught. The courses in drawing, including designing for lace embroidery and garment decoration, painting on glass, porcelain, china, fans and textiles, and the dressmaking and the artificial flower-making are especially notable. The reception room at this school is decorated with fine examples of porcelain tiles and china painting, and the windows are of stained glass, this work all having been done by graduate students. The Communal Trade School for Girls on the Rue du Président, Brussels, is noted for the fact that the trade instructors is also the teacher of the course in design in connection with the trade. The course in embroidery and applied design is especially fine. Another Brussels communal school on the Rue du Poineon, 26, noted for its dressmaking and commercial courses, and the Antwerp School, Rue des Architectes, with its five-year courses in some of the trades, are also examples of the excellent professional training for girls in Belgium.

An advanced trade course of one year for dress designers, dressmakers and intending teachers in trade schools is given in Brussels, a study of the evolution of dress in all countries being a notable part of the work.

The Trade-Housekeeping Schools (écoles professionnellles-ménagères) and the housekeeping-trade schools (écoles ménagères-professionnelles) are also giving more or less time to trade work.

Apprentice Shops for teaching trade work: girls are not numerous, but are doing good work. They were opened in response to local needs rather than as a part of regular trade instruction. One of their distinguishing features is that the students after a time receive financial remuneration for their work. There are several of these schools, as the one at Borsbeke for straw plaiting and straw-hatmaking, at Jemelle for lingerie and dressmaking; at Maldegem for hand and machine embroidery and crochet work on tulle, and at Saint Trond for lacemaking.

The Industrial Schools (écoles industrielles) for boys are similar to the continuation schools of Germany. They are very numerous in the parts of the country and have been organized with reference to local needs. They take a large number of technical subjects connected with the trades which the boys follow during the day. Some of these are also day trade schools and have advanced, as well as elementary work. The general course, with emphasis on French, German, and Flemish languages, arithmetic, history, geography, hygiene and domestic economy, writing, drawing, singing and gymnastics. The instruction is excellent and has been especially adapted...
weaving. The Industrial School at Tournay, which is one of the oldest and most important in Belgium, also partakes of the nature of a technical school. It has no scope of its own, but it has entered into contract with local manufacturers to direct the pupils' practical education. This is an excellent method of combining theoretical with practical instruction. The school gives its theoretical instruction in the early morning or in the late afternoon. The Industrial School of Morlanwelz has departments of mining, building construction, engineering, electricity, shop technology and mechanical drafting. The organization of the school population, the equipment, the excellence of the instruction and the ability of the teaching force make this school a power in the kingdom. The age of the students entering is from below 14 to over 20. The schools of Ghent, Seraing, Châtelet, Charleroi, La Louvière and many other cities are adapting themselves to local industrial conditions and are doing good work. Certain work in the industrial schools is also open to girls, but, with the exception of the commercial courses, it is not well developed.

The Trade School proper for boys is also well developed. Under this head are the day trade schools (for teaching actual trades), the trade continuation schools (for supplementing the day shop work), and the trade schools of fishing. Some of the day trade schools teach but one specific trade, while a number of trades are taught at other schools. An illustration of the first class is the Brussels Trade School of Tailoring. A four years' course is offered. The leading tailoring houses of the city show their interest in this school by contributing to its support, supplying it with order work and helping to place the graduates. The students pay a small entrance and tuition fee. They are paid a small sum for their work, and this money is placed in the state savings bank and given to the student when he completes his apprenticeship, but if he leaves the school before that time he loses the right to the money. The Gun Makers School at Liege for making arms was originally begun by the manufacturers but is now conducted by a committee composed of labor men, city officials and manufacturers. The school is open day and night.

The T. Nicaise Trade School of Metal- and Woodworking at Ghent is an illustration of the class of school offering instruction in several trades.

Jewelry work, chasing, upholstery, furnishing, printing and many other trades are taught in evening or in Sunday morning continuation classes. The trade schools for fishing are placed at the seaports.

The Saint Luke Trade Schools are similar both to the day trade school and to the trade continuation school. They aim particularly to train for artistic branches of the handicraft trades. They were established by the Roman Catholics. The school at Schaerbeek, Brussels, is an illustration of this class of trade school.

Apprenticeship Shops have been organized for weaving and stone cutting and are doing successful work.

France.

France began to plan and legislate for the training of her handworkers centuries ago. The forerunner of the trade school began in 1799, but the great development of the subject has been during the last quarter of a century, following the Paris Exposition of 1900. The number of such schools receiving help from the government increased from 48 in 1880 to 292 in 1904. France appreciates that her industrial success depends on the education of her workmen, hence the government takes a direct part in developing the system of trade instruction. Schools are provided to teach all grades of workers from the semi-skilled artisan in the ordinary trades to the engineer for the more advanced scientific and technical work. Trade training is always founded directly on primary education, design is considered fundamental and a large amount of shop work of a practical nature is given.

Manual apprenticeship schools have been organized to give boys instruction in their chosen industry or to fit them for the secondary technical schools. There are four national trade schools (écoles nationales professionnelles), situated at Armentières, Nantes, Vierzon and Voisins, and 32 trade and industrial schools (écoles pratiques de commerce et d'industrie), 26 for boys which are situated in various parts of France, and six for girls at Boulogne-sur-Mer, Havre, Marseilles, Nantes, Rouen and Saint Etienne. In addition to these, the municipalities of important cities have established schools for the elementary teaching of trades, industries and arts. Religious bodies, societies, business enterprises and private individuals, encouraged by the success of the national and municipal schools, have likewise organized instruction for the improvement of the artisan.

Government control requires that the schools receiving subsidies should all conform to certain requirements. The Practical School of Industry at Saint Etienne (école pratique d'industrie) may be taken as a type of these institutions. The trades of weaving, modeling in wood, machine fitting, calainemaking, electricity and gunmaking are taught here. The work is on an elaborate scale, the course being four years in length. The first year is preparatory and completes the student's primary education while also giving him shop practice of various kinds to discover his aptitude for any trade. During the next three years, he is trained both practically and theoretically, and continues his general education which is closely adapted to his trade needs. Here, as in other schools, much emphasis is laid upon the study of art.

The greatest and most progressive system of municipal trade schools is in Paris. The Diderot School was the first one organized, having been established in 1872 for wood and metal work. The courses are three years in length, entrance being by examination. Practical work occupies the greater part of the day, but considerable time is given to drawing and theoretical instruction. By an ingenious arrangement a first-year student is put between a second and third year student that he may profit by their experience. Apprenticeship is made the subject of a tax on the city from the fact that the products of the classes are sold. The Boullé School trains skilled artisans and mechanicks in wood and metal. The furniture construction is justly noted. The products are artistic as design is
especially emphasized. The course is five years in length, primary academic instruction, trade work, technical art and a scientific course being included in its curriculum. Schools of printing and publishing, applied physics and chemistry, industrial art and industrial drawing are also supported by the municipality of Paris.

There are six municipal trade schools for girls in Paris. The instruction includes art, academic work and the chosen trade, and all courses are either three or four years in length. The trades taught are similar to those in Belgian trade schools for girls. The aim is to educate for a trade, to develop the intelligence of the workers, and to teach them to be self-reliant and resourceful. The French schools execute practical order work in their departments, and every trade school in Paris has its clientele. The model for these municipal schools is the private school begun in 1864 by Elisa Lemonnier. There are two of the Lemonnier schools in Paris at the present time. They offer courses of four or five years in length.

The training for girls in the practical sciences and industry (mentioned above) is similar to that offered in the Paris municipal schools. Schools are also organized which offer both home-making and trade. These are well patronized as many women desire both subjects.

UNITED STATES.

The United States had not many examples of the all-day trade school until recent years, for her problems of national development had taken her full time. The beginnings were usually under private control—expressed in the New York Trade School for Boys and the Manhattan Trade School for Girls. The subjects of instruction at the former are the various building trades such as carpentry, bricklaying, sheet metal and cornice work, electrical work, house and street painting, plumbing, steam and hot water fitting, sign painting, plastering, blacksmithing and printing. It was founded in 1881 by the late Col. Richard T. Aechmuty, who originated the system of instruction. The school is open to both sexes and is the practical branches of the trade. The courses are made as short as possible—usually about four months for the day classes, which provide trades for younger men. The night courses aim at giving additional skill to those already in the trade. The students come from all over the United States, and several thousand have received the certificate and twice as many more have been enrolled. It is claimed that this school has greatly helped the building trades and also has raised the standard of intelligence and efficiency in the working class. The Baron de Hirsch Trade School, also in New York city, offers similar trade training.

The William-on Free School of Mechanical Trades, near Philadelphia, is a different type of trade school. The course is three years in length and the school term extends throughout the year. The pupils are regularly indemnified as apprentices and live at the school. Scholarship examinations are held for admission, and there is no charge for board, clothing or instruction. The trades taught are carpentering, bricklaying, including rance, furnace and boiler-setting, and the machine trade in all of its usual details, patternmaking, steam and electrical engineering and steam fitting. Each student takes but one of the trades named, and the work taught is in the direction of the particular trade. The academic work continues throughout the three years, and special attention is given to ethical training that the pupils may be good citizens as well as good mechanics. It can accommodate but one-fifth of those desiring admission. There are three notable trade schools in San Francisco. The Wilmerding School of Industrial Arts trains for the building trades, the Lux School offers girls home-making and wage-earning courses and the Lick School of Mechanical Arts gives the metal trades. All three schools are under the same principal, though financially independent. There is no charge for tuition, use of tools, instruments or materials. The courses cover four years and the aim is to send intelligent citizens as well as well-instructed workmen into the trade. Graduate courses are also given. The schools are built on adjacent lots and the students can use the shops of either institution. They are free, and the latter is open to both sexes. A competitive examination is held for entrance at the School of Mechanical Arts. A preliminary course of more than two years in general education and manual training is followed by the selection of some trade and apprenticeship in it. The school aims to solve a general problem of teaching various trades as an integral part of education, rather than to meet some special need of the community.

The Wentworth Institute in Boston trains for various skilled mechanical trades in both day and night classes. Like other schools of its type it was of great service in training men for war occupations during 1917 and 1918.

The Carnegie Technical Schools of Pittsburgh offer trade work on a large scale to both sexes as a part of a broad plan of technical instruction. The School for Apprentices and Journeymen gives classes for those already at work. The instruction is both theoretical and practical, with the object of turning out skilled mechanics. The Technical School for Women offers training in home-making and also in wage-earning pursuits.

The Manhattan Trade School for Girls in New York city is a short-time all-day preparatory trade school. It trains for skilled trade work. It is a pioneer school in this class of education and was begun in 1902 under private control, passing into the public school system in 1910. The aim is to shorten the period of apprenticeship of those girls who leave the public schools to go to work, and to create in them an appreciation of the meaning and value of their trade and its relation to the work of the world. The school is open throughout the year, students may enter at any time, are on probation for a time, and each is advanced according to her ability, hence there is no definite length of course; experience has shown that it may be anywhere between six months and two years. The trades offered are: (1) Those with reference to the metal, such as dressmaking and millinery; (2) those that use foot-power and electric-power machines, including such machines as those for embroidery, hemstitching and buttonholes; (3) those
that depend on the expert use of paste or glue, such as labeling, sample mounting, pocket-book and card-casemaking, library outfits, blank book covers, and novelty boxmaking. Practical academic work, as well as drawing and color, are also taught, but always with an eye single to their bearing on the needs of each trade. A certificate is given only after a girl has been tested in a position and has shown her proficiency and also a good spirit in the workroom. The tuition is and in especially deserving cases some financial aid may be given to pupils. The school has the cordial support of some of the foremost philanthropists, trade unionists, social workers and employers of labor of New York city. The Boston Trade School follows closely the plan of the Manhattan Trade School for Girls. It was begun in 1904 and taken over by the city in 1908. Similar trade schools for girls adapted to their communities are found in other cities, Worcester, Massachusetts and Milwau- kee being so noteworthy. Some notable schools for specific trades are to be found all over the United States. The Brewers’ Schools of New York, Chicago and Milwaukee; the Schools of Watchmaking and Repairing in Waltham, Mass., and the Bradley Polytechnic School in Peoria, Ill., and the Barbers’ Schools in Nebraska and other States are instances. Shipbuilding, photography, linotype and many other trades are taught in this class of school.

Business enterprises have also opened trade schools. Many of the institutes for dress-making, so numerous in the large cities, were organized by some firm to teach a special system of drafting patterns.

The Apprenticeship or Corporation School is also found, being represented by such instruction as is given their workmen by the school of Messrs. R. Hoe and Company, manufacturers of printing presses, and the Carriage Builders’ National Association (both in New York city), the Ladies’ Home Journal, Philadelphia, the General Electric Company, at West Lynn, Mass., and great railroads, such as the New York Central and the Atchison, Topeka and Santa Fé.

Night classes for teaching trades are to be found in connection with the work of social and religious bodies. The Saint George’s Trade School of New York city belongs to this class. The Catholic Prosectory, near New York city, is teaching numerous trades for both sexes as a part of its scheme of reformation, and similar work is done in other institutions of this character.

Trade or technical teaching in institutions with other educational aims is found frequently. The pressure to introduce this work has been so great that trade classes have been offered in a variety of places, some of them receiving State or Federal aid. Much of the instruction is of a supplementary character, to take the place of apprenticeship. The technical features are usually more prominent than the special shop practice. Pratt Institute, Brooklyn, offers classes which resemble those of the trade continuation schools. The fundamental aim of the institute is for “industrial and technical instruction,” but it has responded to the call for two-hour night classes to train boys for carpentering, machine work, plumbing and fresco painting. Trade classes for girls are also given. The technical classes are justly noted, but they do not aim to prepare apprentices for the trade. The Drexel and Spring Garden institutes in Philadelphia, the Mechanics Institute in Rochester, the Hebrew Technical institutes for both sexes and the Clara de Hirsch Home in New York city and the Christian associations are instances of institutions with other aims giving attention to trade instruction.

The great schools for the colored people and Indians have been foremost in inaugurating trade education as an adjunct to their academic or normal aims. The Hampton Normal and Agricultural Institute in Virginia, the Tuskegee Normal and Industrial Institute and the Agricultural and Mechanics College in Greensboro, N. C., are examples of these schools. They have developed for both sexes almost all of the leading trades. The work is given in the most practical manner, as the shops are for productive industrial work, not for training instruction. Trade teaching in these schools has been placed on a high ground and the results have justified the wisdom of the methods chosen.

Continuation, co-operative and part-time classes are increasing in number. Massachusetts, New York, Wisconsin and Indiana have been foremost in enacting laws to further vocational education and have organized various forms of trade classes to help their working people. Other States are following rapidly. Department stores are using the continuation schools for training their sales-people and are also organizing part-time classes in their own buildings. In Massachusetts the trade schools in Beverly and Fitchburg have begun an inter-relation with the industries in their towns and the school in part-time instruction. Vocational work in the later grades of the school is rapidly increasing and serves to guide young workers into occupations suited to their ability, thus preparing them for entering trade or taking further training at a school.

The passing of the Federal bill for vocational education gave a great impetus to training boys and girls below college grade for trades and industries. The object of the measure, stated tersely, is to promote training in agriculture, trades, industries and home economics, and also to train teachers for vocational positions. The Federal board is also authorized to make investigations and to send out reports. It supervises and controls the work it assists, and works in connection with the State boards—the Federal and State boards acting as an agent. During the European War (by special legislation) it prepared men for various branches of war work and is still giving training to disabled soldiers, sailors and marines.

Austria.

The Austrian government has developed an exceptionally logical system of trade instruction for both sexes. The legislation in regard to fostering handicrafts has been similar to that taking place in Germany and has had a great effect on the development of trade training. The schools of all grades are carefully classified and grouped. Classes for trade is given in schools for particular trades and in the industrial continuation schools.
TRADE SCHOOLS

Another group, known as the Central Industrial Educational Institutions, which are most of them in Vienna, have for their function the promotion of industrial education and to serve as models for other branches of the empire. Some of these schools offer both a lower and a higher trade education in connection with their other important lines of investigation.

The Schools for Particular Trades are very numerous. There were about 100 state schools and more than half that number of private or state subsided schools in the report of 1899. Important examples of this class are the schools for lace work and hand and machine embroidery in Dornbirn and Laybach; for weaving in Reichenberg, Vienna, Schönberg and Warnsdorf; for wood, iron and stone work in Bergreichenstein, Bozen, Chrudim, Bruck aus der Mur and Laas; for earthenware and glasswork at Teplitz and Oberentensdorf; for metal work in Klagenfurt, Swistiniki and Nizza and for other trades in Gabling, Turnau and Karlsbad.

The Industrial and Trade Continuation Schools are also extensively developed and are similar to the German models of the same name. They have reached their highest development in Vienna. A great central school enrolls about 8,000 pupils. The school is open for 10 months, six days a week. The work is compulsory for four years for both sexes. A watch and clock making all-day school is in the same building.

SWITZERLAND.

The Swiss are an industrious and practical people and their schools show the national characteristics. This country has the distinction of having provided the model for the first French trade school. As early as 1599 Saint Francis de Sales conducted a school which maintained an industrial section. The Duke de la Rochefoucauld, while traveling in Switzerland, heard of the school, and, at his own expense, founded a similar one in France, which later became a National School of Arts and Trades.

The Federal government has developed an excellent system of subsidizing and supervising trade schools. The continuation school is the favorite, and they are similar in character to those of Germany, though the special trade features are not so well developed. They are found in all of the cantons and are for both sexes.

The Industrial Art Schools are giving training to apprentices in the trade, as well as advanced instruction. The cantonal School of Industrial Arts at Geneva, devoted purely to the art industries, and the Trade and Industrial Art School in Bern, combining other industries with its art work, are examples. Certain classes in both of these schools are open to women.

The Trade Schools proper cover a wide field of occupations. Of those teaching a simple trade, the watchmaking schools are the most numerous. Woodworking, embroidery, and weaving schools are also characteristic of Switzerland. Many of the schools teach several arts. The course is usually three years in length and includes such art and academic work as is felt to be necessary for the under-

standing of the trade. These schools have had for their models the German, Belgian and French institutions of a similar character. The art work is generally less notable, however. The cantons of Appenzell, Bern, Genoa, Neuchâtel, Saint Gall, Soleure and Zürich have successful trade schools as well as apprentice shops.

Trade instruction for women is also well developed. Many of the trade schools include the housekeeping element; as is the case in Germany and France. The Trade and Housekeeping School (école professionnelle-ménagère) in Geneva offers a three-year course. The work produced resembles the French in precision of technique and beauty of execution, but has, perhaps, less artistic value. Of the trade schools proper a good example is the school for ladies' tailoring and lingerie making at Zürich. Pupils must be over 14 years of age and present certificates showing a good general education. Courses of three or four years are offered, which include practical work at the chosen trade, theoretical instruction concerning it, auxiliary academic subjects, drawing and drafting and at least six months' service in the salesroom connected with the school. The Bern Women's Handwork School (Frauenarbeitersschule) also gives trade training, but does not at present include art or academic work in its curriculum.

Schools for housekeepers and servants have been developed in Switzerland and give excellent courses of several months' duration. All of the ordinary work of housekeeping, cooking, baking, preserving, serving, cleaning, sewing, repairing, washing, ironing, gardening, sweeping and putting rooms in order is included in the course. An effort to lengthen the time of training is being made. Lenzburg, Bern and Boniswil have good schools of this class.

The Swiss trade school is felt to have a beneficial effect on the working man and woman as well as on the industries, and is favored by the labor unions. Although the schools have not created new industries, they have been the means of developing many. The schools of wood-carving have done much to impart this trade, and machine work, taught in the schools, brought prominently forward. The products of this industry are largely exported to the United States.

ENGLAND.

The trade school proper was not developed to as great an extent in England as on the Continent. Although technical education has received attention, there have been until recently but few instances where the day schools aimed to take the place of actual apprenticeship. This was due largely to the Education Act of 1899, which forbade the practice of any trade, industry or employment in the schools. The education acts later took a more favorable attitude toward trade instruction, and government aid can now be given for fostering such schools. They are rapidly increasing.

Supplementary trade work is largely offered in the night continuation classes, which resemble those of Germany, and attract large numbers of students. There are about 80,000 in London alone. Mr. Robert Blair of the Money Educational Commission, says in his report on
technical education in the United States: "We are in the main trying to do in one institution — the evening school — what Germans and Americans are in the main endeavoring to do in two.\textsuperscript{8} The night classes are open to both sexes. Girls do not take much advantage of them, however, for the reason that nine or 10 hours of work during the day leave but little energy for resuming workshop practice. Although the polytechnics have done much for the industries, they are not of the type that has fostered real trade instruction in the day classes. Such instruction, however, has recently been increasing. A late report gives the number of day trade students in or near London as 5,800. These are provided for in 35 well-equipped workshops (principally in the polytechnics) in which 200 courses are given bearing on 33 different trades. The evening classes are doing a fine work in training older workers for better positions. Day preparatory trade schools are being organized. Engineers of high rank are urging educational facilities for apprentices, workmen and experts equal to those offered on the Continent of Europe.

Trade training for girls has not been greatly encouraged by the working class. The germ of it has been the excellent domestic economy schools. The Women's Industrial Council of London is doing much to foster trade schools for girls as a part of education. The London County Council has opened an All-Day Trade School of the apprenticeship type. It began under private control but was taken over by the city in 1907. A girl can enter at 14 and remain two years. A day continuation school has also been opened for girls at work. The Borough Polytechnic in London opened in 1904 Day Trade Waistcoat-Making School for Girls, and other polytechnics have followed the example. General education, art and domestic science are included in the one-year course. The council is urging that similar day courses be offered at each technical institute in London, in order to train workers for all good trades employing women.

ITALY.

Education for industrial pursuits began seriously in Italy after the national union. In 1898 vigorous reforms took place in the schools which raised the standard of teaching and reorganized the courses of study. The schools were founded chiefly by individuals. They differ widely in type, in object and in program. Many of the schools receive subsidies from the state as well as from the provincial or communal authorities, or from chambers of commerce, or from the savings banks. The government exercises a certain class of supervision over those schools receiving subsidies. Although there is no co-ordination between the schools there is a response to local needs. As in other countries, there are several grades of schools. The schools of arts and trades (scuole d'arti e mestieri) train the workmen. There are very numerous in cities and small towns, and are unevenly distributed through Italy. Piedmont, Lombardy, Campagna and Tuscany have the greater number. The instruction in many of them deals more with the technical features than with the academic and theoretical. As in other conti-

\textsuperscript{8} Bibliography.—(Reports\textsuperscript{9} of the Commissioner of Labor (Washington, annually); reports\textsuperscript{10} of the United States Commissioner of Education (ib., annually); reports\textsuperscript{11} and \textquoteright Bullets\textquoteright of the National Society for Vocational Education (New York); reports\textsuperscript{12} and \textquoteright Monthly Summaries\textquoteright of the Federal Board for Vocational Education; reports\textsuperscript{13} of the Royal Commission on Technical Education for Great Britain (London, annually); Proceedings of the International Congresses for Technical, Commercial and Industrial Education; \textit{Annuaire de la jeunesse} (Paris); Some Trade Schools in Europe,\textsuperscript{14} United States Bureau of Education, Bulletin No. 23 (Washington 1914); reports\textsuperscript{15} of the Massachusetts Commission on Industrial and Technical Education (Boston 1900, 1908); A Glance at Some European and American Vocational Schools,\textsuperscript{16} issued by the Consumers' League of Connecticut (Hartford 1911); Chamberlain, A. H., \textquoteleft The Condition and Tendencies of Technical Education in Germany\textquoteright (Syracuse 1908); Cooley, E. G., \textquoteleft Vocational Education in Europe\textquoteright (Chicago 1912); Damm, P., \textquoteleft Die technischen Hochschulen Preussens\textquoteright (Berlin 1909); Dean, \textquoteleft The Worker and the State\textquoteright; Kerschensteiner, G., \textquoteleft Education for Citizenship\textquoteright; id., \textquoteleft Organisation und Lehrpläne der obligatorischen Fach-und Fort-bildungsschulen für Knaben in München\textquoteright (Munich 1910); Roman, F. W., \textquoteleft The Industrial and Commercial Schools of the United States and Germany\textquoteright (New York 1910); Seres, J., \textquoteleft Education for Industrial Purposes\textquoteright (Bologna 1911); Woolman, M. S., \textquoteleft The Making of a Trade School\textquoteright (Boston 1910).   

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TRADE UNIONS, as defined by the Federal statutes, are associations of working people for the several purposes of aiding members toward greater efficiency, promoting their general intelligence, raising of funds for the benefit
of sick, disabled or unemployed members or the families of deceased members, and for the regulation of their wages and hours and conditions of labor, and the protection of their interests. Rights in the benefit funds of the trades. The primary object was to assist members in contest with employers, and it was not for some time later that the unions introduced funeral benefits, homes for incapacitated workers, scholarships, etc. See American Federation of Labor; Guilds; Unionism.

TRADE UNIONS, General Federation of, a labor organization of Great Britain, aiming to unite all the British trade unions for mutual assistance and the advancement of the interests of labor. It admits any trade union to membership, but no branch or individuals. It was organized in 1899 at a special session of the British Trades Union Congress. The government is vested in a general council of representative delegates meeting annually, and in an executive "management committee" of 15, no two to be of the same trade. District committees may also be organized. Any union dissatisfied with the management committee may appeal to the council, and from the council to the vote of the general membership. The federation deals solely with industrial questions, particularly with the conduct of strikes, and aims to preserve industrial peace. All unions joining the federation pay an entrance fee of one penny (two cents) per member and regular dues are paid on two different scales, the higher scale, sixpence (12 cents) per quarter per member, the lower scale, threepence (6 cents) per quarter per member; all payments are calculated on 90 cents per member. In case of a strike approved by the general council or the management committee, unions that have belonged to the federation 12 months are entitled to a strike benefit of five shillings ($12.50) per week per member on the higher scale, and half that amount on the lower scale. Several large and representative unions have joined the federation; among them are the Amalgamated Society of Engineers, the Boot and Shoe Operatives, the Cotton Spinners, the Shipwrights, the Tailors and the Gas-workers and General Laborers. The membership approximates 1,000,000. See Unionism.

TRADE WINDS, one of those perpetual or constant winds which occur in all open seas on both sides of the equator, and to the distance of about 30° north and south of it. On the north of the equator their direction is from the northeast (varying at times a point or two of the compass either way); on the south of the equator they proceed from the southeast. In some places the trade winds become periodical, blowing one-half of the year in one direction and the other half in the opposite direction. They receive their name because their known regularity is an assistance to trading vessels which often lay their courses so as to receive as much assistance as possible from favorable breezes. See also Currents; Ocean; Meteorology.

TRADING STAMPS, printed slips given by some merchants as an inducement to the trade. They are not三年级 that they may be pasted in a book which is furnished and which when filled has a value in premiums offered. These stamps are used extensively and are said to be of considerable value in working up trade. They have been the cause of lawsuits brought against the issuing firms under the law forbidding lotteries.

TRADITION, the body of oral information, opinion, inexact records, statements, and evidence of things long past communicated from older generations to the present. That evidence of ancient things which is not committed to writing and vouched for by competent authority. As applied to profane history it signifies knowledge of the past handed down by word of mouth from generation to generation. In this sense the line between tradition and myth is often hard to distinguish, one merging into the other. Historical tradition, however, has usually, if not invariably, a substantial foundation and both tradition and myth are of the highest value in tracing human experience and progress both in the historic and prehistoric periods—for it should be unnecessary to state that the so-called historic period is not a uniform era, but varies with different races of mankind, according to the age at which they come within the range of historic observation.

Tradition in the religious sense holds a place not less important than in its profane meaning. It is a chief ground of doctrinal division in Christianity and also in Mohammedanism, between Roman Catholics and Protestants in the former faith and between Sunnites and Shiites in the latter. A similar division is common among the Jews of the later Scriptural period. In the Roman Catholic view the term tradition is applied to the doctrines believed to have been communicated by Christ to his Apostles and handed down by them orally to their successors. The writings of the Fathers are regarded as witnessing these traditions. The Council of Trent teaches that the truth of Christ is contained partly in the sacred writings and partly in the unwritten tradition received by the Apostles from Christ, or from the Holy Ghost, and entrusted by them to the Church, and that Scriptural and apostolic tradition are alike to be revered. See Catholic Church; Jewish Sects; Mohammedanism; Protestantism; Shiites; Sunnites.

TRADUCIANS (from traduce, transmit), a name which the Pelagians anciently gave to the Catholics because of their teaching that original sin was transmitted from father to children. More commonly the term is applied to the theory that souls are transmitted to children by the parents, instead of being created by God. Saint Augustine appears to have inclined to this belief, without committing himself to it.

TRAFALGAR, trä-fäl-gär', or trä-fäl-gär', a cape on the southwest coast of Spain, at the northwest entrance of the Strait of Gibraltar. It is low and sandy and terminates in two headlands, on the east of which is a lighthouse. The famous naval battle in which Nelson lost his life, after defeating the combined French and Spanish fleets under the command of Villeneuve and Gravina, was fought off this cape on 21 Oct. 1805. A monument was erected on the summit of the capes. (See J. S. 'The Campaign of Trafalgar' (London 1918).
TRAGACANTH, GUM TRAGACANTH, GUM TRAGIC, a gummy exudation from the stem of various species of Astragalus, natives of the mountainous regions of western Asia. It comes on the market as irregular leaves or ribbon-like pieces, of a white or brownish-white color and somewhat translucent. It swells up in water; does not readily dissolve but forms a gelatinous mass which is sometimes utilized as a mucilage. Used in pharmacy to give consistence or pell-mell mass. It is also used to stuff calicoes and other fabrics.

TRAGEDY, a serious drama or poem, representing an important event or a series of events in the life of some person or persons, in which the diction is elevated and the catastrophe melancholy. Tragedy originated among the Greeks in the worship of the god Dionysus or Bacchus. See DRAMA.

TRAGOPAN, a pheasant of the genus Ceriornis, closely allied to the common fowl. C. satyrus, a common species, is a native of the Himalayas where it inhabits the forests at 8000 to 11,000 feet elevation. The plumage is spotted, exceedingly brilliant and variegated in colors and two flesh protruberances hang from behind the eyes. When the bird is excited it can erect these protruberances till they look like a pair of black male hares at either side of the lower mandible. Unlike most pheasants they build their nests in trees.

TRAILL,trail, Catherine Parr Strickland, Canadian writer, sister of Agnes Strickland (q.v.): b. London, 9 Jan. 1802; d. Lakefield, Ontario, 29 Aug. 1879. She was married in 1832 to Capt. Thomas Traill with whom she removed to Canada in 1833 and made her home for the rest of her life at Lakefield, Ontario. Among her works are 'The Backwoods of Canada' (1835); 'Canadian Crises' (1852); 'Ramblings in the Canadian Forest' (1854); 'Afar in the Forest' (1869); 'Studies of Plant Life' (1884); 'Peals and Pebbles' (1895).

TRAILL, Henry Duff, English journalist and man of letters: b. Blackheath, Kent, 14 Aug. 1842; d. London, 21 Feb. 1906. He was graduated at St. John's, Oxford, 1864, called to the bar in 1868, but soon took to literature. He was connected with the Pall Mall Gazette (1873-80), the Saint James' Gazette (1880-82), Telegraph (1882-96) and the Saturday Review (1883-94). From 1889 to 1891 he was editor of the Observer, from 1898 to 1900 of Literature. Among his publications are 'Lives' of Stradford (a very original work with a new view) (1889); 'William III' (1888); 'Sterne (1882); Coleridge (1884) and others; also 'Central Government' (1881); 'Recaptured Rhymes' (1882); 'The New Lucian' (1884; revised and enlarged 1900), his best work; 'Saturday Songs' (1890), satirical verse; 'From Cairo to the Soudan Frontier' (1896) and 'The New Fiction and Other Essays on Literary Subjects' (1897).

TRAIN, Elizabeth Phipps, American novelist and translator: b. Dorchester, Mass., 1 Sept. 1856. She was educated at Wells College, Aurora, N. Y., and her first literary work consisted entirely of translations from the French. They include 'The Apostle' (1889); 'Recollections of the Court of the Tuileries' (1891), etc. Her first original publication was "Dr. Lamar" (1891) and she has since written 'Autobiography of a Professional Beauty' (1895); 'A Social Highwayman' (1895); 'Queen of Hearts' (1897) and other works.

TRAIN, George Francis, American financier and eccentric author: b. Boston, 24 Mar. 1829; d. New York, 18 Jan. 1904. In 1850 he was put in charge of the Liverpool branch of an American business house and three years later was admitted to partnership. Another branch was established in Melbourne, Australia, in 1853, under his supervision, and during the three years of his stay there he introduced a sailing-ship service between Boston and Australia. In 1858 he interested English capital in the building of the Atlantic and Great Western Railway and afterward undertook street-railway enterprises in England and other European countries, but his plans, through opposition and otherwise, were frustrated. His next railroad enterprise was the building of the Union Pacific Railway, for which was broken at Omaha 2 Dec. 1863 and the connection that linked the eastern and western extremities completed 10 May 1869. He made a tour of the world in 80 days, arriving in Marseilles, France, 20 Oct. 1870, where he organized the Commerce, was arrested and imprisoned for 13 days at Lyons. In 1872 he became an independent candidate for President of the United States. He was a man of eccentric habits and extravagent speech and in November 1872 was arrested on the charge of having published obscene scene literature. The passages objected to were wholly quotations from the Bible. Mr. Train was discharged from custody after having been adjudged insane by legal decision. His later years were spent in New York, where he adopted the habit of speaking only to children. He called himself "Citizen of the World," and while his title to property valued at $30,000,000 at Omaha, Neb., remained in litigation he affected a simple style of living and spent his last years at a cheap hotel, where he died. Among his publications are 'An American Merchant in Europe, Asia and Australia' (1851); 'Young America Abroad' (1857); 'Young America in Wall Street' (1858); 'Young America on Slavery' (1860); 'Champion of Women' (1868) and 'My Life in Many States and in Foreign Lands.'

TRAIN BANDS, a body of citizens partaking of the nature of both militia and volunteers, instituted by James I and dissolved by Charles II. The term was afterward applied to the London militia, from which the third regiment of the line originated and in which the renowned John Gilpin was a captain.

TRAINED NURSE. See Nurse, Trained.

TRAINED TEACHERS. See Education, Elementary.

TRAINING, Athletic. See Physical Training.

TRAINING SCHOOL FOR TEACHERS. See Teachers, Professional Training.

TRAINING SCHOOLS, Nautical. See Nautical Training Schools.

TRAJAN, traj'an (MARCUS VELIPIUS TRAJANUS), Roman emperor: b. Italic (near Seville), in the Spanish province of Bética, 53
A.D.: d. Selinus, Cilicia, 17. He was the son of Trajanus, a Roman commander under Vespasian. He accompanied his father in a campaign against the Parthians and also served on the Rhine with such ability that when Nerva came to the throne he adopted the young soldier and raised him to the rank of Caesar (97). Nerva dying a few months after, he succeeded to the throne (98). He was at that time in Germany, where he remained for more than a year, to settle a peace with the German tribes, and in 99 set out with a numerous escort to Rome. After largess to the soldiers and people he took successful measures for supplying the capital with corn. He punished and banished informers, reduced the taxes and filled the most important posts with men of talent and integrity. He moreover founded libraries, and under his patronage the studies were revived which had suffered from the persecution of Domitian. By the unanimous voice of the Senate he was awarded the title “Optimus.” In 101 he set out on an expedition against Decebalus, king of the Dacians, who had forced Domitian to purchase peace by an annual payment of money, and after two years defeated the Dacians and returned to Rome to enjoy the honors of a triumph with the name of Dacicus (103). In this year Pliny was made governor of Pontus and Bithynia, which circumstance gave rise to a series of letters between him and Trajan still extant. Among these are the epistles respecting the Christians, whom he directs Pliny not to search for, but only to punish if brought before him. In 104 Decebalus renewed the war with the Romans in pursuing which Trajan constructed a bridge over the Danube, below the modern Orsova, which was one of the greatest works of antiquity (105). He then marched into Dacia, reduced the capital of Decebalus and turned Dacia into a Roman province. It was in commemoration of his wars in Dacia that he erected the sculptured column which still bears his name. In 114 he dedicated the Forum that he had built in Rome and set out on a new warlike expedition against Chosroes, the Parthian. The result of this war was the reduction of Armenia to a Roman province. His war with the Parthians was completed in two campaigns, after which he sailed down the Tigris and entered the Persian Gulf. During his absence the Parthians revolted. After giving a king to the Parthians he laid siege to Atra, the capital of an Arabian tribe, but was obliged to withdraw to Syria. In the following year (117) he proposed returning into Mesopotamia, but was attacked by a disorder, which induced him to repair to Italy, leaving the army under the command of Hadrian. He had proceeded no farther than Selinus, in Cilicia, when he died, after having adopted Hadrian for his successor. His good qualities as a ruler were such that, at the distance of 250 years from his death, the senators, in their acclamations on the accession of a new emperor, were accustomed to wish that he might be more fortunate than Augustus and better than Trajan.

**TRAJAN’S COLUMN.** See ROME; TRAJAN.

**TRAJAN’S WALL,** Rumania, a fortified line in the Dobrudja extending east from the Danube to Kustendji on the Black Sea, a distance of 37 miles. It is a double, in some places, a triple, earthwork on the south side of a natural fosse consisting of a narrow marshy valley. Another wall of the same name, built by a Roman legion, 105–155 A.D., extends from the Pruth east to the Black Sea.

**TRAMP.** See MENDICANCY.

**TRAMWAYS, Aerial.** See CONVEYER; WIRE ROPE.